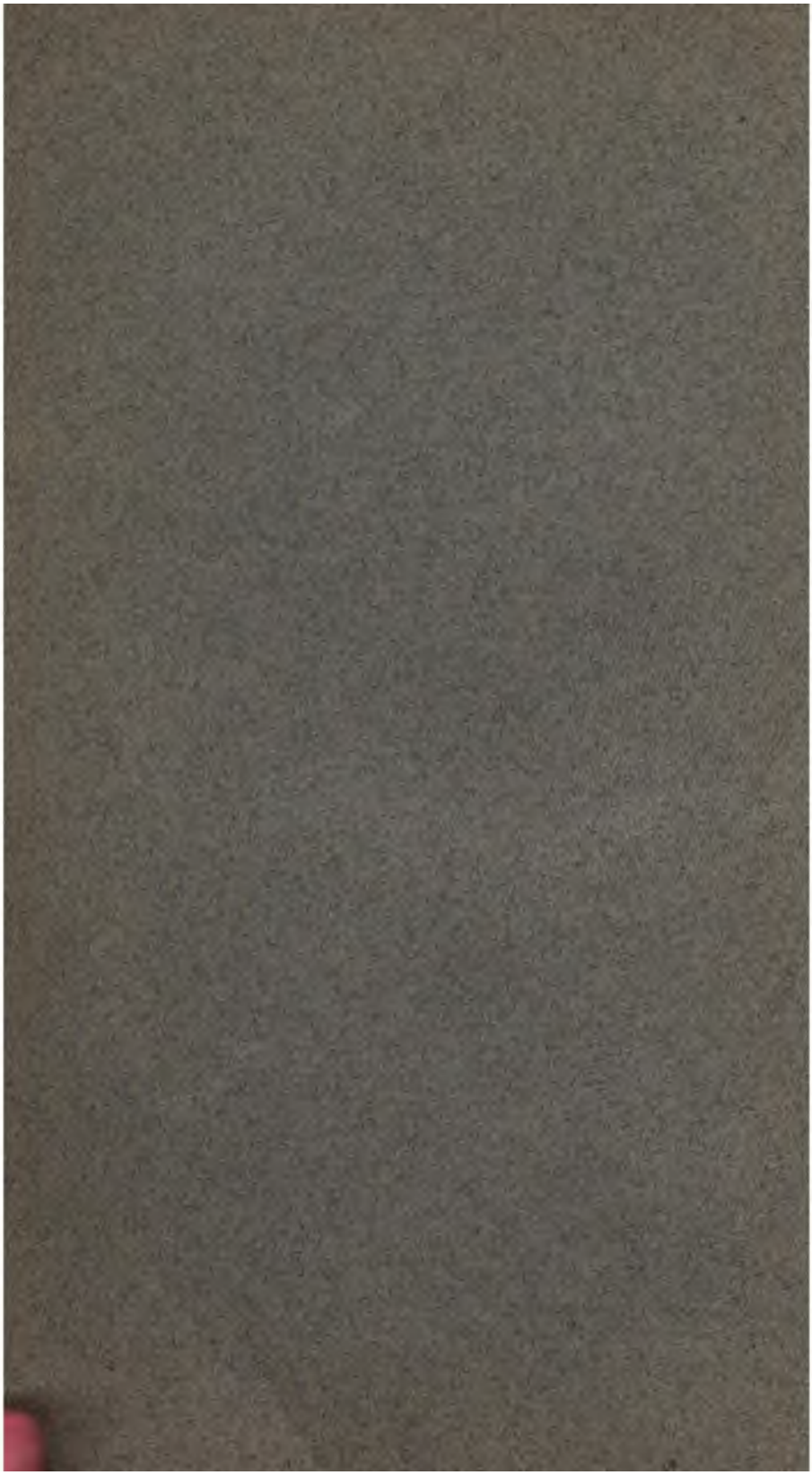
QUARTERLY

Vol. 1. No. 2.

Entered as second-class mail matter, July 10, 1906, at the Post Office at Golden, Colorado, under the Act of Congress of July, 16, 1894.



SIMON GUGGENHEIM HALL

Administration Building

QUARTERLY

OF THE

COLORADO SCHOOL OF MINES.

Vol. I. No. 2.

Catalogue Edition.

GOLDEN, COLORADO.

1906-1908

TABLE OF CONTENTS.

COLLEGE CALENDAR.

1906.

November	29..	Thursday ..	THANKSGIVING RECESS.
November	30..	Friday	
December	24..	Monday	CHRISTMAS RECESS BEGINS.

1907.

January	5..	Saturday	CHRISTMAS RECESS ENDS.
January	19..	Saturday	FIRST SEMESTER ENDS.
January	21..	Monday	SECOND SEMESTER BEGINS.
February	22..	Friday	WASHINGTON'S BIRTHDAY. (A Holiday.)
May	24..	Friday	SECOND SEMESTER ENDS. COMMENCEMENT EXERCISES.
May	27..	Monday	FIELD SURVEYING BEGINS.
June	22..	Saturday	FIELD SURVEYING ENDS.
August	28..	Wednesday	Examinations for Entrance to the Class of 1911 and Re-examination of Matriculated Students.
August	29..	Thursday .	
August	30..	Friday	
September	3..	Tuesday ...	Opening of the First Semester of the Academic Year, 1907-8.
November	28..	Thursday ..	THANKSGIVING RECESS.
November	29..	Friday	
December	23..	Monday	CHRISTMAS RECESS BEGINS.

1908.

January	4..	Saturday	CHRISTMAS RECESS ENDS.
January	18..	Saturday	FIRST SEMESTER ENDS.
January	20..	Monday	SECOND SEMESTER BEGINS.
February	22..	Saturday ..	WASHINGTON'S BIRTHDAY. (A Holiday.)
May	22..	Friday	SECOND SEMESTER ENDS. COMMENCEMENT EXERCISES.
May	25..	Monday	FIELD SURVEYING BEGINS.
June	20..	Saturday	FIELD SURVEYING ENDS.
August	27..	Wednesday	Examination for Entrance to the Class of 1912 and Re-examination of Matriculated Students.
August	28..	Thursday ..	
August	29..	Friday	
September	2..	Tuesday ...	Opening of the First Semester of the Academic Year 1908-9.

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The Relation of Technical to Cultural Education.

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The Geology of the Clear Creek District.

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The Applications of Electricity.

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The Cyanide Treatment of Gold and Silver Ores.

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Mexican Mining Methods.

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Chlorination.

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Practices of the State Bureau of Mines.

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The Geology of Butte, Montana.

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Counsel, Amalgamated Copper Mining Company.
Mining Litigation.

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Testing Engineer, New Reduction Works, Anaconda Copper Mining Company.
The Work of the Testing Department of the Anaconda Copper Mining Company.

R. H. SALES, E. M., Butte, Montana.
Assistant Geologist, Anaconda Copper Mining Company.
Mining Geology.

B. H. DUNSHEE, Butte, Montana.
Assistant Superintendent, Amalgamated Copper Mining Company.
Sinking a Permanent Shaft.

J. T. ROBERTS, Anaconda Montana.
Chief Clerk, New Reduction Works.
Accounting in a Large Smelter.

E. P. MATHEWSON, Anaconda, Montana.
Manager, New Reduction Works, Anaconda Copper Mining Company.
The Organization of a Large Smelter.

GEORGE F. SHELTON, Butte, Montana.
Counsel for W. A. Clark Interests.
Mining and Agriculture.

WILLIAM WRAITH, E. M., Anaconda, Montana.
Assistant Superintendent, New Reduction Works, Anaconda Copper Mining Company.
The Organization of the New Reduction Works.

J. C. REPATH, Anaconda, Montana.
Mechanical Engineer, New Reduction Works, Anaconda Copper Mining Company.
The Importance of Mechanical Engineering in Metallurgical Plants.

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Of Barker & Wilson, Civil and Mining Engineers.
The Plumbing of a Shaft.

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Hydro-Electric Development in Montana.

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Editor of *The Mining Reporter.*
The Progress of Metallurgical Processes in Colorado.

C. W. GOODALE, Butte, Montana.
General Manager, Boston and Montana Consolidated Copper and Silver Company.
Mining and Metallurgy, Past and Present.

HISTORY, ORGANIZATION, FINANCIAL SUPPORT, AND LOCATION.

HISTORY.

The Colorado School of Mines was established by an act of the Territorial Legislature, approved February 9, 1874. After an unsatisfactory experience in temporary quarters, the School was permanently housed in the original "building of 1880," upon land given by the citizens of Golden. Since then the School has enjoyed a strong and steady growth in buildings, in equipment, in students, in Faculty, and in the strength and rigor of its courses. Additions were made to the original building of 1880, by the buildings of 1882, and by the building of 1890. Engineering Hall was erected in 1894, the Stratton Assaying Laboratory in 1900, and the new hall for Mining and Metallurgy, called Stratton Hall, was completed in 1904. The Heating, Lighting, and Power Plant was completed in 1906. The new Administrative Building, named Simon Guggenheim Hall, for the donor, was also erected in 1906.

ORGANIZATION.

The corporate name of the institution by statute is "The School of Mines." The general management of the Colorado School of Mines is vested by statute in a Board of Trustees, consisting of five members appointed by the Governor of the State with the advice and consent of the Senate. The members of the Board of Trustees are appointed in alternating sets of two and three, and hold their office for a period of four years and until their successors are appointed and qualified. The Board of Trustees elect one of their number President. They also appoint a Secretary and Treasurer either from their own number, or from some

other suitable persons as they may deem best. Any three of said Board of Trustees constitute a quorum for the transaction of business. The President of the Faculty of the School, who shall be appointed by the said Board of Trustees, shall be known as "President of the School of Mines." By the organic Constitution of Colorado, the School of Mines is regarded as an Institution of the State.

FINANCIAL SUPPORT.

The Colorado School of Mines is supported by the income derived from the annual tax of one-fifth of a mill on each dollar of the assessed property of the State, and this is known as the "School of Mines Tax." In addition to this the Legislature has from time to time provided by special appropriation for such emergency funds as the means of the State treasury and the necessities of the School might suggest.

LOCATION.

The Colorado School of Mines is in the south central part of the city of Golden, Jefferson County. Golden is about thirteen miles from Denver, and can be reached by the Colorado and Southern Railroad from the Union Station at the foot of Seventeenth Street, by the Denver and Intermountain Railway, from the Arapahoe Street Station, between Fourteenth and Fifteenth Streets, or by the Denver and Northwestern Electric Railway, from the Loop on Fifteenth Street, between Arapahoe and Lawrence Streets, Denver.

Golden has about three thousand inhabitants and is one of the oldest cities in Colorado. It is such a residence town as usually clusters around a college, and is the most available mountain or foot-hill home surburban to and available from Denver. The altitude is five thousand seven hundred feet above sea level, or about four hundred fifty feet higher than Denver. The climate is invigorating and pleasant, with open winters and a large proportion of clear days. The surrounding region is rich in the characteristic scenery of the Rocky Mountain region.

The Colorado School of Mines is peculiarly well located to give students both a theoretical and practical training. The equipment of the school enables the theoretical side to be well presented. The nearness to mines, mills, and smelters offers unusual opportunities for inspection visits, and enables the student to see in actual operation every variety of mining and metallurgical work. The Independent Pyritic Smelter is located at Golden. In the Clear Creek canon are the numerous gold mills and concentrators of Gilpin and Clear Creek counties. At Argo, near Denver, the Boston and Colorado Smelting Company illustrates the metallurgy of gold, silver, and copper ores. At the Globe plant of the American Smelting and Refining Company the treatment of lead ores and dry ores of gold and silver is illustrated by up-to-date methods. At Denver also are the Colorado Zinc works, using the most modern methods of magnetic and electric separation, and in addition there are numerous sampling and ore testing works. The many mining and metallurgical machinery plants of Denver also afford an excellent opportunity for becoming acquainted with recent improvements in metallurgical design. At Colorado City are the Portland and Standard mills for the chlorination treatment of gold ores, and the Golden Cycle Mill for cyanidation; at Cripple Creek, the Cripple Creek and Homestake mills; and at Florence, the Union mill. The plant of the Colorado Fuel and Iron Company at Pueblo possesses all the recently invented and approved devices for the production of iron and steel and for working these products into marketable forms. At Pueblo there are also three lead smelters, the Pueblo, Eilers and Philadelphia, and the zinc smelter of the Colorado Zinc Company. At Canon City are the plants of the Empire Zinc Company and of the United States Reduction and Refining Company, and at Leadville, the Arkansas Valley smelter. The Black Hills, where good practice in gold milling and cyanidation is to be found, and the great copper smelters of Montana, are visited on longer trips.

At or near Golden are numerous clay mines and quarries and extensive coal mines well equipped with hoisting and power machinery. In the Clear Creek canon, within

a short ride of Golden, are the mining camps of Central City, Black Hawk, Idaho Springs and Georgetown, and placer mining at Breckenridge. The well-known mining camps of Cripple Creek, Victor, Leadville and Aspen, as well as the San Juan region, including Silverton, Ouray and Telluride, are also easily reached by train from Denver. Besides these there are also available the bituminous mines of the Northern Coal Fields, the anthracite fields of Glenwood Springs, the oil fields of Florence, the iron mines of Wyoming, and the copper regions of Arizona and Montana.

No other mining school in the country has within easy access such a wide variety of mining properties, or such excellent opportunities for observing the latest and best smelting operations.

REQUIREMENTS FOR ADMISSION.

FRESHMAN CLASS.

The following requirements for admission to the Freshman Class of the Colorado School of Mines are in harmony with the Report of the Commission of the North Central Association of Colleges and Secondary Schools, adopted March 28, 1902, and are in harmony with the recommendation of the University and High School Conference held at Boulder, Colorado, December 12, 1903. They are also in harmony with the Report of the Committee of the American Mathematical Society on Definitions of College Entrance Requirements in Mathematics, appointed at the summer meeting of the American Mathematical Society, September, 1902.

REQUIREMENTS FOR THE FRESHMAN CLASS.

Unit Course. A unit course of study is defined as a course covering a school year of not less than thirty-five weeks, with four or five (preferably five) periods of at least forty-five minutes each per week.

Sixteen Units are required for entrance, of which twelve are specified, and four may be chosen from a list of electives.

SPECIFIED UNITS.

Algebra	1½	units
Plane Geometry	1	unit
Solid Geometry	½	unit
Languages, other than English	2	units
English	3	units
History	2	units
Physics	1	unit
Chemistry	1	unit
Specified Units	12	
Elective Units	4	
Total Units for Entrance	16	

ELECTIVE UNITS.

The four elective units may be selected from the following list: Drawing, Shop Work, Mathematics, Greek, French, German, Spanish, History, English, Science, Psychology. Political Economy.

In allowing credit for drawing and shop work two forty-five minute periods will be regarded as equivalent to one forty-five-minute period of classroom work. Half units are accepted in all studies, except in physics and chemistry, provided that not less than one full unit shall be accepted in language.

METHODS OF ENTRANCE.

(a) By Certificate.

Graduates of Accredited High Schools in the State of Colorado will be admitted without examination upon the presentation of proper credentials from the Principal of their High School, provided that the studies they have sucessfully completed cover the requirements for admission. Blanks for this purpose will be sent on application to the President.

Graduates of Accredited High Schools in other States will be accepted in the same manner as graduates of Accredited High Schools in Colorado.

(b) By Examination.

All other candidates for admission will be required to pass entrance examinations in the specified subjects. These examinations are held in Golden.

For the benefit of students who cannot, on account of the distance, conveniently take the examination at Golden, arrangements will be made so that they may take the examinations under the direction of some responsible person at or near their own homes.

Entrance examinations for the class of 1911 will be held in Golden on Wednesday, Thursday and Friday, August 28, 29 and 30, 1907.

It is the opinion of the Faculty of the Colorado School of Mines that every candidate for the Freshmen class should have taken a thorough course of at least four years in a good High School or in a Manual Training School, and

during the last year of his preparation, should have a thorough review of mathematics, or should have received an education equivalent to one of these. The work of the school is so exacting that students who are not well prepared cannot expect to succeed after entrance.

DESCRIPTION OF THE UNITS REQUIRED FOR ENTRANCE.

ENGLISH (3 UNITS).

(a) GRAMMAR. The student should have a sufficient knowledge of English grammar to enable him to point out the syntactical structure of any sentence which he encounters in the prescribed reading. He should also be able to state intelligently the leading grammatical principles when he is called upon to do so.

(b) READING. The books prescribed by the Joint Committee on Uniform Entrance Requirements in English form the basis for this part of the work.

The list is divided into two parts, the first consisting of books to be read with attention to their contents rather than to their form, the second consisting of books to be studied thoroughly and minutely. The lists, thus divided, are as follows:

I. Books prescribed for reading.

For 1907 and 1908: Shakespeare's *The Merchant of Venice* and *Macbeth; The Sir Rodger De Coverly Papers* in The Spectator; Irving's *Life of Goldsmith;* Colebridge's *The Ancient Mariner;* Scott's *Ivanhoe* and *The Lady of the Lake;* Tennyson's *Gareth and Lynette, Lancelot and Elaine,* and *The Passing of Arthur;* Lowell's *The Vision of Sir Launfal;* George Eliot's *Silas Marner.*

II. Books prescribed for study and practice.

For 1907 and 1908: Shakespeare's *Julius Caesar;* Milton's *Lycidas, Comus, L'Allegro and Il Penseroso;* Burke's Speech on *Conciliation with America;* Macaulay's *Essays on Addison and Life of Johnson.*

(c) COMPOSITION. Regular and persistent training in both written and oral composition should be given throughout the entire school course. The topics should be

so chosen as to give practice in the four leading types of prose discourse, namely, description, narration, exposition, and argument.

(d) RHETORIC. It is expected that the student will be familiar with the essential principles of rhetoric. The instruction in this subject should include the following particulars: choice of words, structure of sentences and paragraphs, the principles of narration, description, exposition and argument. The teacher should distinguish between those parts of rhetorical theory which are retained in text books merely through the influence of tradition and those which have direct bearing upon the composition work. The former may be safely omitted.

HISTORY (2 UNITS).

Any two of the following may be offered:

I. Ancient History, with special reference to Greek and Roman History, including also a short introductory study of the more ancient nations and the chief events of the early middle ages, down to the death of Charlemagne (814).

II. Mediaeval and Modern European History, from the death of Charlemagne to the present time.

III. English History.

IV. American History, or American History and Civil Government.

PHYSICS (1 UNIT).

PHYSICS. The equivalent of Carhart and Chute's *High School Physics,* or Gage's *Principles of Physics,* including systematic laboratory practice such, for example, at is outlined in Crew and Tatnall's *Labaratory Manual in Physics.*

CHEMISTRY (1 UNIT).

GENERAL CHEMISTRY. The equivalent of Bradbury's *Elementary Chemistry* or Remsen's *Briefer Course of Inorganic Chemistry.*

MATHEMATICS (3 UNITS).

I. ALGEBRA. (1½ Units.) The four fundamental operations for rational algebraic expressions; factoring,

highest common factor; lowest common multiple; complex fractions; the solution of equations of the first degree containing one or more unknown quantities; radicals, including the extraction of the square root of polynomials and numbers; fractional and negative exponents; quadratic equations and equations containing one or more unknown quantities that can be solved by the methods of quadratic equations; problems depending upon such equations; a review of the essentials should be followed by ratio and proportion, and the binomial theorem for positive integral exponents; the progressions; the elementary treatment of permutations and combinations; the use of four and five place tables of logarithms.

II. PLANE GEOMETRY. (1 Unit.) Completed, including the solution of original exercises and numerical problems.

III. SOLID GEOMETRY. (½ Unit.) Properties of straight lines and planes; of dihedral and polyhedral angles; of projection; of polyhedrons, including prisms; of pyramids and the regular solids; of cylinders, cones and spheres; of spherical triangles, and the measurement of surfaces and solids.

The two units required in languages other than English may be offered in Greek, Latin, French, German or Spanish.

ADMISSION TO ADVANCED STANDING.

GRADUATE STUDENTS. Applicants who are graduates of colleges or technical schools of good standing will be admitted upon the presentation of proper credentials and will be permitted to take any subject taught in connection with the regular courses. Each case will be judged on its own merits, but such applicants will be advised to become candidates for a degree and to complete the regular work of the college. Such graduates will find the advanced courses of the school well adapted to fit them for professional engineering work.

UNDERGRADUATE STUDENTS. Applicants who have partially completed the course in colleges or technical schools of good standing will be admitted upon the presen-

tation of proper credentials. Due credit will be allowed for the successful completion of work which is equivalent to that given in the Colorado School of Mines. Plates of drawings, laboratory note books, and catalogues of the institution attended, should be submitted with applications for advanced standing. The college does not admit special students. All applicants for advanced standing are expected to enroll in one of the regular classes and to become candidates for a degree. Application blanks for advanced standing will be furnished on request to the President.

DEGREES.

The college offers two four-year courses—Mining Engineering and Metallurgical Engineering—leading to the degrees of E. M. (Mining Eingineer) and E. Met. (Metallurgical Engineer).

THESIS AND GRADUATION.

A thesis upon some suitable subject is a prerequisite to the completion of either course. Each senior must submit to the Faculty, not later than November 1st, the subject of his thesis, which must be approved by the Professor concerned. Each thesis must be typewritten or printed on eight and one-half by eleven-inch paper, bound in book form, and submitted not later than May 1st.

No diploma will be delivered until the thesis is handed in, the full requirements of the course of study are satisfied, and all accounts with the college are settled.

DEPARTMENTS OF INSTRUCTION.

TABULAR VIEW.

MINING ENGINEERING.

Freshman Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
College Algebra [p. 78]....	5		Analytic Geometry [p. 80].	5	
Trigonometry [p. 79].....	3		Elements of Analysis [p. 79]	3	
General Chemistry [p. 71].	5		General Chemistry [p. 71].	5	
Qualitative Analysis			Qualitative Analysis		
Lectures [p. 72].....	1		Lectures [p. 72].....	1	
Laboratory [p. 72].....		9	Laboratory [p. 73].....		6
Descriptive Geometry			Elementary Machine Design [p. 62].....	2	
Lectures [p. 62].....	2		Engineering Drawing [p. 63]		9
Drawing [p. 62].....		6			
General Geology [p. 49]...	3		Plane Surveying [p. 54]....	2	

Plane Surveying: Field-Work [p. 55]. Four weeks in the summer following the regular college year.

Mining Trips to Central City, Idaho Springs, Georgetown and Leyden [p. 82].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

MINING ENIGNEERING—Continued.

Sophomore Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Differential and Integral Calculus [p. 80]	5		Integral Calculus [p. 80]	3	
			Theoretical Mechanics [p. 81]	2	
General Physics: Mechanics, Heat and Sound [p. 76]	4		General Physics: Electricity, Magnetism and Optics [p. 77]	4	
Physical Laboratory [p. 77]		3	Physical Laboratory [p. 77]		3
Quantitative Analysis: Gravimetric.			Quantitative Analysis Volumetric.		
Lectures [p. 73]	1		Lectures [p. 74]	1	
Laboratory [p. 73]		9	Laboratory [p. 74]		9
Technical Chemistry [p. 75]	2		Technical Chemistry [p. 75]	2	
Crystallography			Determinative Mineralogy		
Lectures [p. 51]	2		Lectures [p. 51]	2	
Laboratory [p. 51]		6	Laboratory [p. 51]		6
Mine Surveying [p. 35]	2		Mine Surveying [p. 36]	2	

Geological Field-Work [p. 50].

Mine Surveying: Field-Work [p. 36]. Four weeks in summer following the regular college year.

Mining Trips to Cripple Creek and the Northern Coal Fields [p. 82].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

MINING ENGINEERING—Continued.

Junior Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Geology [p. 50]	4		Lithology		
			Lectures [p. 52]	2	
			Laboratory [p. 52]		3
Metallurgy: Fuels, Refractory Materials, Iron and Steel [p. 43]	3		Metallurgy: Lead and Zinc [p. 44]	3	
Mining [p. 37]	3		Mining [p. 37]	3	
Mechanics of Engineering [p. 55]	3		Mechanics of Engineering [p. 57]	3	
Engineering Construction			Mill Construction		
Lectures [57]	2		Lectures [p. 58]	2	
Drawing [57]		3	Drawing [p. 58]		3
Machine Design			Steam Engines and Boilers		
Lectures [p. 63]	2		Lectures [p. 63]	2	
Drawing [p. 63]		6	Drawing [p. 63]		6
Electric Power Transmission			Electric Power Transmission		
Lectures [p. 69]	2		Lectures [p. 69]	2	
			Laboratory [p. 69]		3
Assaying			Testing Laboratory [p. 56]		3
Lectures [p. 44]	1				
Laboratory [p. 44]		9			
Metallurgical Trips, as follows: [p. 83]			Metallurgical Trips, as follows: [p. 83]		
1. Coking Plant			1. Smelting Plant for the study of furnace types		
2. By-product Plant and Gas Producers			2. Iron and Steel Works		
3 Refractory Materials			3. Lead Smelter		
			4. Zinc Smelter.		

Mining Trips to Leadville and Breckenridge [p. 82].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

MINING ENGINEERING—Concluded.

Senior Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Economic Geology [p. 51]	3		Economic Geology [p. 51].	3	
Ore Dressing			Metallurgy: Gold, Silver, and Copper		
Lectures [p. 45].....	4		Lectures [p. 45].....	3	
Laboratory [p. 45].....		3	Laboratory [p. 47].....		3
			Practice [p. 47].....		3
Hydraulics [p. 59].....	3		Contracts and Specifications [p. 60]	2	
Hyd. and Cement Laboratory [pp. 59, 60].....		3			
Compressed Air Machinery [p. 66]	2		Pumping Machinery [p. 67]	2	
Gas Engines [p. 67].....	2		Special Mining Machinery [p. 68]	2	
Steam Laboratory [p. 68]..		3	Mining Laboratory [p. 39].		3
Power Plant Design			Mine Plant Design		
Lectures [p. 64].....	2		Lectures [p. 64].....	2	
Drawing [p. 64].....		6	Drawing [p. 64].....		3
Mining [p. 38].....	2		Mining [p. 38].....	2	
Mine Ex. and Rep. [p. 38]	2		Economics of Mining [p. 39]	2	
Thesis		3	Thesis		6
Ore Dressing Trips, as follows: [p. 83]			Metallurgical Trips, as follows: [p. 83].....		
1. Sampling Works			1. Copper Smelter		
2. Concentrating Plants..			2. Gold Milling Plant....		
3. Magnetic and Electric Separating Plants ..			3. Cyanide and Chlorination Mill		

Geology. Advanced Field-Work [p. 50[.

Senior Mining, Metallurgical, and Geological Trip to Colorado Springs, Pueblo, Florence, Canon City, Leadville, and Aspen, Colorado; Park City, Bingham, Newhouse, Frisco, Milford, and Eureka, Utah; Butte and Anaconda, Montana; Black Hills, Deadwood, Lead and Terry, South Dakota [p. 85].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING.

Freshman Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
College Algebra [p. 78]....	5		Analytic Geometry [p. 80].	5	
Trigonometry [p. 79].....	3		Elements of Analysis [p. 79]	3	
General Chemistry [p. 71].	5		General Chemistry [p. 71]..	5	
Qualitative Analysis			Qualitative Analysis		
Lectures [p. 72].....	1		Lectures [p. 72].....	1	
Laboratory [p. 72]		9	Laboratory [p. 73].....		6
Descriptive Geometry			Elementary Machine Design [p. 62].....	2	
Lectures [p. 62].....	2		Engineering Drawing [p. 63]		9
Drawing [p. 62].....		6			
General Geology [p. 49]...	3		Plane Surveying [p. 54]...	2	

Plane Surveying: Field-Work [p. 55]. Four weeks in the summer following the regular college year.

Mining Trips to Central City, Idaho Springs, Georgetown and Leyden [p. 82].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING—Continued.

Sophomore Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Differential and Integral Calculus [p. 80].....	5		Integral Calculus [p. 80]...	3	
			Theoretical Mechanics [p. 81]	2	
General Physics: Mechanics, Heat and Sound [p. 76].....	4		General Physics: Electricity, Magnetism, and Optics [p. 77].....	4	
Physical Laboratory [p. 77]		3	Physical Laboratory [p. 77]		3
Quantitative Analysis: Gravimetric.			Quantitative Analysis: Volumetric.		
Lectures [p. 73].....	1		Lectures [p. 74].....	1	
Laboratory [p. 73].....		9	Laboratory [p. 74].....		9
Technical Chemistry [p. 75]	2		Technical Chemistry [p. 75]	2	
Crystallography			Determinative Mineralogy		
Lectures [p. 51].....	2		Lectures [p. 51].....	2	
Laboratory [p. 51].....		6	Laboratory [p. 51].....		6
Mine Surveying [p. 35]....	2		Mine Surveying [p. 36]....	2	

Geological Field-Work [p. 50].

Mine Surveying: Field-Work [p. 36]. Four weeks in summer following the regular college year.

Mining trips to Cripple Creek and the Northern Coal Fields [p. 82].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING—Continued.

Junior Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Geology [p. 50]	4		Lithology Lectures [p. 52]	2	
			Laboratory [p. 52]		3
Metallurgy: Fuels, Refractory Materials, Iron and Steel [p. 41]	5		Metallurgy: Lead and Zinc [p. 42]	5	
Mining [p. 37]	3		Mining [p. 37]	3	
Mechanics of Engineering [p. 55]	3		Mechanics of Engineering [p. 57]	3	
Engineering Construction Lectures [p. 57]	2		Mill Construction Lectures [p. 58]	2	
Drawing [p. 57]		3	Drawing [p. 58]		3
Machine Design Lectures [p. 65]	1		Steam Engines and Boilers Lectures [p. 65]	1	
Drawing [p. 65]		3	Drawing [p. 65]		3
Metallurgical Chemistry [p. 75]		6			
Electric Power Transmission Lectures [p. 69]	2		Electric Power Transmission Lectures [p. 69]	2	
Laboratory [p. 69]		3			
Testing Laboratory [p. 65].		3	Assaying Lectures [p. 44]	1	
			Laboratory [p. 44]		9
Metallurgical Trips, as follows: [p. 83] 1. Coking Plant 2. By-product Plant and Gas Producers 3. Refractory Materials..			Metallurgical Trips, as follows: [p. 83] 1. Smelter Plant for the study of furnace types 2. Iron and Steel Works. 3. Lead Smelter 4. Zinc Smelter		

Mining Trips to Leadville and Breckenridge [p. 82].

The courses are described on the pages indicated after each course.

TABULAR VIEW.

METALLURGICAL ENGINEERING—Concluded.

Senior Year.

First Semester	Rect. Hrs.	Lab. Hrs.	Second Semester	Rect. Hrs.	Lab. Hrs.
Economic Geology [p. 51].	3		Economic Geology [p. 50]..	3	
Ore Dressing			Metallurgy: Gold, Silver and Copper		
Lectures [p. 45].....	4		Lectures [p. 45].....	4	
Laboratory [p. 45].....		3	Aluminum, Nickel and Metals not elsewhere treated		
			Lectures [p. 46].....	3	
Electro-Metallurgy			Metallurgical Laboratory		
Lectures [p. 48].....	3		[p. 47]		6
Laboratory [p. 48].....		3	Metallurgical Practice [p. 47]		3
Power Plant Design			Metallurgical Plant Design		
Lectures [p. 66].....	1		Lectures [p. 66].....	1	
Drawing [p. 66].....		3	Drawing [p. 66].....		3
Hydraulics [p. 59].....	3		Contracts and Specifications [p. 60].....	2	
Compressed Air Machinery [p. 66]	2				
Hyd. and Cement Laboratory [pp. 59, 60].....		3			
Steam Laboratory [p. 68]..		3			
Mining [p. 38].....	2		Mining [p. 38].....	2	
Mine Ex. and Rep. [p. 38]	2		Economics of Mining [p. 39]	2	
Thesis		3	Thesis		6
Ore Dressing Trips, as follows: [p. 83]			Metallurgical Trips, as follows: [p. 83]		
1. Sampling Works			1. Copper Smelter		
2. Concentrating Plants..			2. Gold Milling Plant ...		
3. Magnetic and Electric Separating Plants ..			3. Cyanide and Chlorination Mills		

Geology: Advanced Field-Work [p. 50].

Senior Mining, Metallurgical, and Geological Trip to Colorado Springs, Pueblo, Florence, Canon City, Leadville and Aspen, Colorado; Park City, Bingham, Newhouse, Frisco, Milford and Eureka, Utah; Butte and Anaconda, Montana; Black Hills, Deadwood, Lead, and Terry, South Dakota [p. 85].

The courses are described on the pages indicated after each course.

MINING.

PROFESSOR LEWIS EMANUEL YOUNG.
ASSISTANT PROFESSOR ARTHUR JOSEPH HOSKIN.

The courses in this department are designed to instruct the student in the theory and practice of mineral land and underground surveying; in the application of the sciences to the art of mining; in the principles and applications of the power machinery used in the mineral industry; in the best methods and practices of mining engineers and mine managers.

I MINE SURVEYING. *Lectures.*

This course covers the practical phases of the duties of a U. S. Deputy Mineral Surveyor. Lectures are given upon the legal requirements in locating and patenting mineral ground. Actual and imaginary cases are taken up and the practical work of putting them through the various steps is done. The school is well situated for the field course which supplements the class-room work, the student being given sufficient field experience to render him familiar with the approved methods of surveying lode, placer, and mill-site claims. Complete field notes are taken of problems assigned in the field. These are subsequently put through the office calculations and a complete set of documents prepared for filing in the offices of the U. S. Surveyor General and the Land Office. The theory and practice of determining the meridian and latitude from direct solar observations are included in this course.

Prerequisites: Mechanical Engineering, I. to IV. inclusive.
Mathematics, I. to IV. inclusive.

Geology, I.
Civil Engineering, I. and II.

Texts: Underhill, *Mineral Land Surveying.*
Morrison, *Mining Rights.*

Two hours per week during the first semester of the Sophomore year. (Hoskin.)

II. MINE SURVEYING. *Lectures.*

Attention is given to the practices of underground surveying. Instruction is given in carrying meridians into mines, laying out workings, keeping notes, estimating areas and tonnage, and in the many other duties which are assigned to a mining engineer. Surveying with hand transits and with auxiliary telescopes is taught. The organization of field parties is handled. The determination of dip and strike of ore or coal bodies from drill-hole data, and various methods of locating mine openings for the advantageous opening, development, drainage, haulage, and production of mines are emphasized. The platting of notes and the construction of maps are important subjects taught.

Prerequisite: Course I.

Text: Young, *Mine Surveying Methods.*

Two hours per week during the second semester of the Sophomore year. (Hoskin.)

III. MINE SURVEYING. *Field-Work.*

Each student is given personal instruction and practice in the survey of mines and mining claims. The squads are limited in size in order that each man may learn all the details of the work and appreciate the importance of every phase of the subject. Among the problems assigned are the following: the complete survey of a mining claim; the survey and mapping of a coal or clay mine; the survey and mapping of a metal mine; the complete survey and mapping of a property, including claims, buildings, and mine workings.

Prerequisites: Courses I. and II.

Four weeks in the summer following the regular work of the Sophomore year. (Hoskin.)

IV. MINING.

This course is preliminary to the lectures on mining methods, and includes excavating and breaking ground, prospecting, boring, tunneling, and shaft sinking. The various tools used in excavating, boring, and drilling, the use of explosives in breaking ground, the methods and tools of prospecting and the general and special methods of tunneling and shaft sinking are described in detail in the classroom.

Prerequisites: Courses I. II. and III.
Mathematics, I.-VII., inclusive.
Physics, I.-IV., inclusive.
Geology, I. and II.
Mineralology, I. and II.

Texts: Gillette, *Rock Excavation.*
Stauffer, *Modern Tunnel Practice.*

Three hours per week during the first semester of the Junior year. (Young.)

V. MINING. (Mining Engineering Course only.)

A study of methods used in securing the various mineral products comprises the work of this course. The economical systems developed in coal, copper, iron, and low-grade gold and silver mines are studied in detail. The application of these systems to the various types of deposits is emphasized throughout the lectures.

Prerequisite: Course IV.

Text: Foster, *Ore and Stone Mining.*

Three hours per week during the second semester of the Junior year. (Young.)

VI. MINING. (Metallurgical Course only.)

This course has the same general outline as Course V., but includes also an outline of the general principles included in Courses VIII. and IX.

Prerequisite: Course IV.

Text: Foster, *Ore and Stone Mining.*
Kent, *Mechanical Engineer's Pocketbook.*

Three hours per week during the second semester of the Junior year. (Young.)

VII. MINING.

In this course the lectures include the support of excavations, mine ventilation, and hoisting. The use of steel, iron, and concrete in mines, the gases and the ventilation of metal mines, and economic hoisting for various conditions receive careful attention.

Prerequisites: Course IV. and either V. or VI.
Mechanical Engineering, either VIII. or XI.

Text: Behr, *Hoisting from Great Depths.*
Sanders, *Mine Timbering.*

Two hours per week during the first semester of the Senior year. (Young.)

VIII. MINING.

In this course the following topics receive attention: systems of transporting the mineral product underground, of carrying it to the mills and railroads, and of draining and unwatering mines. The detailed study of the machinery necessary in these operations is included in Mechanical Engineering, Courses XIII., XV. and XVI.

Finally, the lectures consider safety devices at mines, accidents and their prevention, first aid to the injured, and mine laws and regulations.

Prerequisite: Course VII.

Two hours per week during the second semester of the Senior year. (Young.)

IX. MINE EXAMINATION AND REPORTS.

This course is given in order to train students for general field-work, for the preparation of reports, and for the examination of mining properties. The lectures comprise the presentation and discussion of the different types of reports which a mining engineer may be called upon to make, the facts which should be included in such reports, and the form and style in which they should be written and illustrated. Each student studies various reports of reputable engineers preparatory to submitting any original work.

Reports on prospects and machinery are then prepared by each student. The field methods of the best engineers in the examination of mining properties are then carefully considered. The methods of sampling and estimating ore bodies are studied and each student is required to sample several properties and to make complete reports.

Prerequisites: Course IV. and either V. or VI.
This course is taken in conjunction with Economic Geology.

Text: Rickard, *Ore Sampling.*

Two hours per week during the first semester of the Senior year. (Young.)

X. MINING LABORATORY. (Mining Engineering Course only.

Practical work is given in the testing of pumps, compressors, hoists, rock drills and other special machines used in mining operations and in the mine plant. Special work is given in the operation of electric and compressed-air rock drills under various conditions and in the transmission and reheating of compressed air. Other special features include the sharpening and tempering of steel, the examination of the effect of timber preservatives on timber, and of mine water on cement and concrete for mine structures. Safety appliances are tested under various conditions. A large portion of this work is carried on in the laboratory, while the remainder is conducted out doors, or at mines under actual working conditions.

Prerequisites: Course VII.
Mechanical Engineering, XVII.

Three hours per week during the second semester of the Senior year. (Young, Hoskin.)

XI. ECONOMICS OF MINING.

The lectures of this course consider carefully the organization, operation, and management of mines and especially the economic problems upon which successful management depends. Special lectures are given on the organiza-

tion of mining companies, mine accounts, mine management, efficiency of mine labor and machinery, the responsibility of emplyoyers, and the ethics of mining enginering. The importance of the financial element is forcefully illustrated by special financial problems, using data from various mining districts.

Prerequisite: Course IX.

Text: Rickard, *Economics of Mining.*

Two hours per week during the second semester of the Senior year. (Young.)

XII. COAL MINING. (Optional.)

A detailed study of mining methods, explosives, mine gases, ventilation, and haulage systems used in coal mining is presented in an optional series of lectures. The organization, operation, and management of typical properties in various districts receive careful attention.

Prerequisite: Course IV.

Two hours per week during the second semester of the Junior or Senior year. (Young, Hoskin.)

XIII. MINING LAW.

This subject is presented in a review of the important laws governing general business and in a special study of laws regulating the mineral industry.

Prerequisite: Course III.

One hour per week during the first semester of the Junior or Senior year.

METALLURGY.

PROFESSOR FRANK WEISS TRAPHAGEN.
ASSISTANT PROFESSOR WILLIAM GEORGE HALDANE.

The aim of this department is to provide a foundation for practical work in metallurgy. In the lecture room attention is constantly directed to the principles involved in the treatment of ores, especially to chemical reactions and the influence of mass, temperature and other conditions upon these changes. In the laboratory, metallurgical operations are given a critical study, and all the resources of the chemical and of the assay laboratories are drawn upon. The purpose is to equip the college with working size apparatus, illustrating the different types of metallurgical and ore dressing plants, and to have these operated by students, who will check up each operation by careful tests in the laboratories.

I. METALLURGY. *Fuels, Refractory Materials, Furnaces, Iron and Steel.*

(Metallurgical Engineering Course only.)

FUELS. This important subject begins with the study of the theory and principles of combustion, air required for complete combustion, weight and volume of products of combustion, and heat carried away by gases, the work being supplemented by numerous problems. Then the various fuels, solid, liquid and gaseous, natural and prepared, are considered at length. Calorific values are determined from ultimate analyses and compared with results determined by actual experiment. In this connection also the treatment of by-products is taken up. Following this, the various types of furnaces, *i. e.*, blast, rever-

beratory and muffle used in metallurgical operations are studied, individual furnaces being dealt with in detail under particular metals. The subjects of calorimetry and pyrometry are considered and instruments compared.

REFRACTORY MATERIALS. The source and properties of the various refractories, their manufacture into crucibles and bricks, and methods of testing are dealt with and considered in detail.

IRON AND STEEL. The development of the metallurgy of iron, and the general application of labor-saving devices, together with the fundamental principles involved in smelting makes it necessary to study these metals first.

The subject is treated in the following order: ores of iron; metallurgical chemistry of iron; blast furnaces; construction; reactions occurring in the operation; hot blast stoves; dust catchers and other accessories; utilization of blast furnace gases; calculation of the furnace charge; wrought iron, production and treatment by direct and indirect methods, including a study of puddling furnaces, forge and mill machinery.

STEEL. Acid and basic open hearth, acid and basic Bessemer processes are considered in detail, and the cementation process and manufacture of crucible steel taken up at some length.

Prerequisites: Chemistry, I. to X. inclusive.
Physics, I. to IV. inclusive.
Geology, I. and II.
Mineralogy, I. and II.
Mathematics, I. to VII. inclusive.

References: Sexton, *Fuels and Refractory Materials.*
Greenwood, *Iron and Steel.*

Five hours per week during first semester of the Junior year. (Haldane.)

II. METALLURGY. *Lead and Zinc.*

(Metallurgical Engineering Course only.)

LEAD. The metallurgy of lead is considered in the following order: properties of lead and its compounds; ores

of lead; sampling and purchasing of lead ores; fluxes and fuel; reverberatory smelting; smelting in the ore hearth; roasting of ores, including the chemistry of the roasting process; blast furnace smelting, including construction; chemistry of the blast furnace; calculation of furnace charges; treatment of products; softening, desilverization, and refining of base bullion; Pattinson process; Parkes process; German and English cupellation.

ZINC. This course comprises a study of the following topics: calcination; roasting and distillation by various methods, including a detailed study of furnace types, direct fired, semi-gas and gas fired; manufacture of retorts; refining of spelter and general cost of production.

Prerequisite: Course I.
References: Hofman, *Metallurgy of Lead.*
Ingalls, *Metallurgy of Zinc.*

Five hours per week during the second semester of the Junior year. (Haldane.)

III. METALLURGY. *Fuels, Refractory Materials, Iron and Steel.*

(Mining Engineering Course only.)

This course is somewhat similar to Course I., the idea being to study only the fundamentals involved in these metallurgical operations, and to give the student a general idea of blast furnace work, and the manufacture of iron and steel.

Prerequisites: Chemistry, I. to X. inclusive.
Physics, I. to IV. inclusive.
Geology, I. and II.
Mineralogy, I. and II.
Mathematics, I. to VII. inclusive.

References: Sexton, *Fuels and Refractory Materials.*
Greenwood, *Iron and Steel.*

Three hours per week during the first semester of the Junior year. (Haldane.)

IV. METALLURGY. *Lead and Zinc.*

(Mining Engineering Course only.)

This course comprises a general study of lead smelting, including ores, sampling, roasting and subsequent treatment in blast furnace and methods of desilverizing and refining. A short lecture course on the metallurgy of zinc is given after the completion of the work in lead.

Prerequisite: Course III.

Reference: Hofman, *Metallurgy of Lead.*

Three hours per week during the second semester of the Junior year. (Haldane.)

V. ASSAYING.

Special attention is directed toward making this course as practical as possible, and, while the importance of accurate work is at no time lost sight of, constant efforts are made to enable the student to handle a large amount of work in as short a time as possible. As nearly as may be the student is put under smelter conditions, and is early made familiar with the system prevailing in the best conducted laboratories, so that in the end he may be able to take his place at once in such a laboratory without undergoing a "breaking-in" course after leaving school.

The work includes all the assays called for in the laboratory of mine, mill or smelter, and the methods, besides those in use so satisfactorily for many years, include also such "short cuts" as have been introduced by assayers having several hundred assays to make daily. The course covers the following: the fusibility of slags of definite composition made up by careful calculation; the fluxing of limestone ores and silicious ores for practice; the running of lead mixtures of known lead, silica and base content to determine the influence of foreign elements; the assay of sulphide and oxide ores of lead; the assay of gold and silver ores of different types by various methods, with a comparison of results; the assay of zinciferous and cupriferous gold and silver ores, of arsenical and antimonial ores; the crucible and scorification assay of mattes and concentrates; the assay of gold,

silver and base bullions, of tin and platinum ores and special assays.

Prerequisite: The completed work of the Freshman and Sophomore years, with the exception of mine surveying.

One lecture and nine hours' laboratory work per week during the first semester of the Junior year for the Mining Engineering Course, and one-hour lecture and nine hours' laboratory work during the second semester of the Junior year for the Metallurgical Engineering Course.

(Traphagen, Haldane.)

VI. ORE DRESSING. *Lectures.*

The following represent the main divisions under which this subject is studied; jaw and gyratory breakers; rolls; stamps, gravity, steam and pneumatic; special crushing and fine grinding apparatus; apparatus for sizing, including the various types of screens and classifiers; the actual concentrating machines, including jigs, tables and vanners.

Prerequisites: Courses I. II. and V., or III. IV. and V.

Reference: Richards, *Ore Dressing.*

Four hours per week during the first semester of the Senior year. (Traphagen.)

VII. ORE DRESSING. *Laboratory.*

The work consists of sizing tests of the products of various crushers and operations, concentrating by panning and by various mechanical devices, and comparative studies of the different forms of commercial sizing, classifying and concentrating devices.

Prerequisites: Courses I. II. and V., or III. IV. and V.

Three hours per week during the first semester of the Senior year. (Traphagen, Haldane.)

VIII. METALLURGY. *Gold, Silver and Copper.*

GOLD AND SILVER. This course covers the following: metallurgy of gold and silver, including stamp milling, cyanidation, and chlorination of gold ores; chloridizing roasting,

and amalgamation of silver ores; the Russell process and other wet methods for silver; the parting of gold and silver bullion by various commercial methods, with special attention to electrolysis and the sulphuric acid treatment. The various modifications of the cyanide process receive particular attention, especially the treatment of the slimes from zinc precipitation; the Moore filter process; the regeneration of the cyanide; the different methods proposed for precipitating the dissolved gold and the recent attempts to apply the process to silver ores.

COPPER. This subject is considered under the following sub-heads: copper and its ores; distribution of the ores of copper; the sampling and assaying of copper; the chemistry of the calcining process; the preparation of ores for roasting; the roasting of ores in lump form; the roasting of ores in pulverized condition; automatic reverberatory calciners; the smelting of copper; the chemistry of the blast furnace; blast furnaces constructed of brick; blast furnace smelting; pyritic smelting; reverberatory furnaces; the bessemerizing of copper mattes; the electrolytic refining of copper, and the selection of process and arrangement of plant.

Prerequisite: Courses VI. and VII.

References: Peters, *Modern Copper Smelting.*
Park, *Cyanide Process.*
Rickard, *Stamp Milling of Gold Ores.*

Four hours per week during the second semester of the Senior year. (Traphagen.)

IX. METALLURGY. *Aluminum, Nickel and Metals not elsewhere considered.*

(Metallurgical Engineering Course only.)

This course covers the general metallurgy of the metals not previously considered. A study of alloys is made here, and various alloys, especially those of the rarer metals with iron, are given particular attention. The commercial application of electricity to metallurgy is taken up and the different system of electrolytic refining, and also the electrothermic production of metals receive attention.

During this course a series of lectures is given in administration and accounting in metallurgical establishments, in which attention is especially directed to the methods found to give best results.

Prerequisite: Courses VI. and VII.

Three hours per week during the second semester of the Senior year. (Traphagen.)

X. METALLURGICAL LABORATORY.

This covers the comparative treatment of ores by amalgamation, chlorination and cyanidation, with special emphasis given to difficulties of treatment and methods of overcoming such difficulties.

Prerequisites: Courses VI. and VII.

Three hours per week during the second semester of the Senior year. (Traphagen, Haldane.)

XI. METALLURGICAL LABORATORY. (Metallurgical Engineering Course only.)

This course includes optical pyrometers; Junker calorimeter; testing refractory materials for fusibility; influence on refractory power of various elements; thermal gradient; various experiments with iron and steel; microstructure of steel; copper selecting process and chloridizing roasting.

Prerequisites: Courses VI. and VII.

Laboratory Manual: Howe, *Metallurgical Laboratory Notes.*

Three hours per week during the second semester of the Senior year. (Traphagen, Haldane.)

XII. METALLURGICAL PRACTICE.

This course covers the operation of working machines of the various types used in practical metallurgy, including stamp milling, roasting and smelting ores, cyanide and chlorination practice.

Prerequisites: Courses VI. and VII.

The equivalent of three hours per week during the second semester of the Senior year.

(Traphagen, Haldane.)

XIII. ELECTRO-METALLURGY. *Lectures.*

This course is arranged to prepare the student for the practical applications of electro-chemical principles, using as a foundation those principles covered by the course in General Physics. It consists of lectures, illustrated by experiment, recitations, and assigned problems. The subjects are as follows: historical development; the laws of Avogadro and van't Hoff; electrolytic dissociation; electrolytic conduction; potential difference; primary and secondary elements; electro-deposition; fused electrolytes.

Prerequisites: Physics I. to IV. inclusive.

Two lectures and one recitation per week during the first semester of the Senior year. (Wolcott.)

XIV. ELECTRO-METALLURGY. *Laboratory.*

This course is arranged to accompany Course XIII. and consists of the calibration of ammeters, voltmeters, and wattmeters; measurement of electrolytic conductivity; electromotive forces; determination of proper conditions for electro-deposition.

Prerequisites: Physics I. to IV. inclusive.
Course XIII. must be taken in connection with this course.

Three hours per week during the first semester of the Senior year. (Wolcott.)

XV. METALLOGRAPHY. *Lectures and Laboratory Work.*

(Optional.)

This course comprises a study of the constitution and micro-structure of steels and alloys, and their properties as effected by the chemical and mechanical treatment to which they have been subjected.

Prerequisites: Metallurgy, Course I.
Physics, Courses I. to IV. inclusive.
(Haldane.)

GEOLOGY AND MINERALOGY.

PROFESSOR HORACE BUSHNELL PATTON.
INSTRUCTOR G. MONTAGUE BUTLER.
INSTRUCTOR CHARLES EDWARD SMITH.

The School is very fortunately situated for the geologist. The surrounding formations not only present the strikingly clear features so characteristic of the West, but occur in great profusion and variety. In addition certain features peculiar to this particular location afford sufficiently complicated problems to be of great value to the student of geology. It is possible, therefore, without going more than a mile or two from the school to illustrate very effectively most geological problems; and field geology can be carried on at the same time with class instruction.

The subjects presented are classified under three heads: A, Geology; B, Mineralogy; C, Lithology.

A. GEOLOGY.

I. GENERAL GEOLOGY.

This course is intended as a preliminary one and is a preparation for the more advanced course given in the Junior year. It discusses general geological principles more particularly in connection with dynamical, structural, and physiographic geology. The course is essentially a lecture course based on a text book.

Prerequsite: Entrance requirements.

Text: Chamberlin and Salisbury, *Geology (Vol. I., Processes and Their Results)*.

Three hours per week during the first semester of the Freshman year. (Smith.)

II. GEOLOGICAL FIELD-WORK.

In connection with Course I. a certain amount of field work is required. It is intended to illustrate the general principles of geology, including training in the recognition of the simpler types of rocks and in the observation of their attitude and structure; in the use of simple field instruments; in note taking and making of reports; in mapping and section drawing. The work is continued in the sopohomore year, when particular problems are assigned to individual students or squads. These problems are mainly structural in character, such as the tracing and mapping of veins and contacts; the location and study of faults; the mapping and reporting upon clay pits.

Prerequisite: Course I.

Eight afternoons, or their equivalent, during the first semester of the Sophomore year.

(Smith, Patton, Butler.)

III. GEOLOGY.

This course is a continuation of Course I., and is given by means of lectures and text-book work. It deals mainly with historical and stratigraphic geology, with special reference to American areas.

Prerequisites: Mineralogy, I. and II.
Geology, I.

Four hours per week during the first semester of the Junior year. (Butler.

IV. ADVANCED GEOLOGICAL FIELD-WORK.

This course embraces mainly field work in areal geology. Each student is assigned a particular section which he is to study, map, and report upon. This throws the student upon his own resources and gives him not only further practice in geological observation, but also the necessary training for preparing reports based upon his own observations.

Prerequisites: Courses I. II. and III.

Four full days in the field, or their equivalent, during the first semester of the Senior year.

(Smith, Patton, Butler.)

VI. ECONOMIC GEOLOGY.

This course discusses the matter of ore deposits, their nature, occurrence and origin, especially the ores carrying the precious metals. Attention is also given to other natural products of economic value, such as coal, petroleum, and building stones.

Prerequisites: Chemistry I. to VI. inclusive.
Mineralogy I. and II.
Lithology I.

Three hours per week throughout the Senior year.
(Patton.)

B. MINERALOGY.

I. CRYSTALLOGRAPHY.

This course is treated as an essential part of the general work in mineralogy, and only such portion of the subject is especially emphasized as is of practical value in the determination and the proper understanding of minerals. A very thorough drill, however, is given in the more practical portions of the subject. The course is presented through lectures, text books, and practical laboratory work; also by individual quizzes. In connection with the laboratory work each student is required to become thoroughly familiar with crystal forms and combinations such as are found on the usual wooden crystal models, and to determine with the aid of a pocket lens and contact gonimeter the crystal forms of three hundred crystals.

Prerequisites: Chemistry I.-VI. inclusive.

Text: Patton, *Lecture Notes on Crystallography.*

Lecture two hours, laboratory six hours per week, during ten weeks of the first semester of the Sophomore year.
(Patton, Butler, Smith.)

II. DETERMINATIVE MINERALOGY.

This course begins about the middle of November with a five-weeks' drill in the methods of blowpipe analysis, with a view to preparing the student for the practical determina-

tion of minerals. This is followed by determinative mineralogy proper, which continues until the close of the second semester of the Sophomore year.

In this course about two hundred fifty of the most important mineral species are presented by lectures, in which special emphasis is laid on the recognition of minerals by means of their physical properties and crystal forms. The object constantly kept in mind is not the training that will enable one to determine any mineral whatever, but rather to recognize at sight such minerals as are likely to be met with in connection with mining operations. This is what the average mining engineer is expected to do. With this object in view, as thorough a drill as the time will allow is given in the actual handling and determining of minerals in the laboratory. In this work each student is expected to handle, determine, and be examined on, approximately two thousand five hundred individual specimens.

Prerequisite: Mineralogy, I.

Text: Moses and Parsons, *Mineralogy, Crystallography and Blowpipe Analysis.*

Lectures two hours, laboratory six hours per week, from the middle of November to the close of the second semester of the Sophomore year.

(Patton, Butler, Smith.)

C. LITHOLOGY.

I. LITHOLOGY.

This is a lecture course supplemented by laboratory work. The object is to present all the more commonly occurring rocks in such a way as to render their identification at sight reasonably accurate. The methods pursued are purely those applicable to the hand specimen without the aid of microscopic sections. The collection of the school is especially rich in those rocks that are usually encountered in mining operations in Colorado and adjacent states. Special emphasis, therefore, is laid upon such rocks and upon their various alteration forms.

Prerequisites: Geology, I. II. and III.
Mineralogy, I. and II.

Text: Kemp, *Handbook of Rocks.*

Lecture two hours, laboratory three hours per week, during the second semester of the Junior year.

(Patton, Butler, Smith.)

II. PETROGRAPHY. (Optional.)

This course takes up the optical properties of minerals and follows up the course on lithology by a study of thin sections of rocks by means of the microscope. It is an optional course, to be limited to such students as are specially qualified to take it.

Prerequisites: Mineralogy, I. and II.
Lithology, I.

Lectures and laboratory work to be arranged.

(Patton.)

CIVIL ENGINEERING.

PROFESSOR WILLIAM FRANKLIN ALLISON.
ASSISTANT PROFESSOR WILLLIAM JONATHAN HAZARD.

The aim of this department is to prepare the student to make all the necessary surveys, calculations, and estimates that the mining and metallurgical engineer may be called upon to make, and at the same time to give him such a knowledge of plane surveying as will enable him to undertake any of the work that the surveyor is called upon to do in land, city, topographical, and railroad surveying. The practical is constantly emphasized, and to that end the work assigned to the student is such work as the surveyor meets in practice. The many advantages offered by the mineral, coal and clay mines in actual operation near Golden, together with the interest taken by the operators of these mines, as is shown by their willingness to give classes right of way for practicing surveying, make the college particularly strong in this kind of work. This department also aims to perfect the engineering student in the theoretical discussion of strains and stresses in mechanisms and structures. It teaches the practical application of the theory in the design of machinery in general and of structures in detail. The course in hydraulics and hydraulic motors develops the theoretical, empirical, and practical sides of hydraulics. Thorough laboratory practice is required in connection with the courses, thus providing concrete applications of elementary and involved principles.

I. PLANE SURVEYING.

Instruction is given by lectures and recitations in the theory, construction, use and care of the surveyor's instruments of precision. The work includes the adjustment

of instruments; the theory and use of the barometer, planimeter and plane-table; the principles of land, city, topographical, and railroad surveying, and the determination of the true meridian by means of various solar attachments and by direct observation of the sun and of circumpolar stars.

Prerequisites: Mathematics, Courses I. and II.
Mechanical Engineering, Courses I. and II.

Text: Raymond, *Plane Surveying.*

Two hours per week during the second semester of the Freshman year. (Allison.)

II. SURVEYING. *Field Work.*

This course includes adjusting instruments; traverse surveying; observations and calculations for determining distances, areas and volumes; observations for the location of the meridian; the ordinary problems in city surveying; stadia work in connection with a topographical survey of some section near Golden. A short railway line is located, cross-sectioned, and the earthwork computed.

Prerequisite: Course I.

Texts: Pence and Ketchum, *Surveying Manual.*
Searles, *Field Engineering.*

This course occupies four full weeks following the completion of the Freshman year. (Allison.)

III. MECHANICS OF ENGINEERING.

The course consists of the theoretical study of mechanisms and materials, embracing statics of a material point and of rigid bodies; centers of gravity or centroids; chains, cords and cables; moments of inertia and radii of gyration of plane figures; stresses and strains; tension, shearing, compression; torsion, flexure; combined torsion and flexure; elastic curves; safe loads; oblique forces; long columns and continuous beams. Much emphasis is placed upon the rapid and accurate application of principles to commercial forms of materials and mechanisms. The course also introduces the student to the fundamental ideas of the motions of bodies, initially treating the dynamics of a material point with extensions of the theory to finite bodies. The fundamental differ-

ential equations of rectilinear motion are developed, and practical applications are found in the case of falling bodies, upward throw, and uniformly and variably accelerated bodies. Newton's laws are the basis of these latter items and also of the hypothetical "Engineers' Mass." The principles of harmonic motion are derived and discussed fully in connection with the Scotch Yoke, and the steam engine receives its preliminary introduction to the student. Colliding bodies receive attention in the discussion of the principles of impact.

Prerequisites: Mathematics, Courses I. to VII.
Mechanical Engineering, Courses I. to IV.

Texts: Church, *Mechanics of Engineering.*
Church, *Notes and Examples in Mechanics.*
Problem Sheets.
Cambria Steel.

Three hours per week during the first semester of the Junior year. (Allison.)

IV. TESTING LABORATORY.

This course acquaints the student with the difficulties attending the practical application of theory. It emphasizes systematic and logical presentation, shows the importance of small details, secures data for future use, and provides a criterion as to the value of a student in his profession. Tests are made to determine the strength and stiffness of building materials such as cast-iron, wrought-iron, steel, and wood in tension, compression, shearing, and flexure. Stone and brick are examined for strength, absorption, disintegration, and other qualities which decide their economic values. The correct dimensioning and surfacing of specimens also forms an integral part of the course. Steel forms are submitted to the students for the determination of the centers of gravity and the moments of inertia. Written reports covering the apparatus, procedure, data, computation, results, and conclusions are required from each student.

Prerequisite: This course must be taken in conjunction with Course III.

Three hours per week throughout the Junior year. (Hazard.)

V. MECHANICS OF ENGINEERING.

This course is an extension of Course III. Virtual velocities introduce the first elements of the principles of work and energy and serve as a basis of discussion in the treatment of the curvilinear motion of a material point which follows. Under this latter head the general equations and principles of curvilinear motion are derived and then applied to simple and cycloidal pendulums, to planetary motion, to a projectile in vacuo, to a body on smooth curved guide, and to absolute and relative velocities. For use in the motion of rigid bodies, the moments of inertia of the common geometrical solids are derived, after which the dynamics of rigid bodies are studied. The conceptions of equivalent and of equilibrating systems are involved in the study of rotating bodies, compound pendulums, rudimentary engines, fly-wheels, eccentric pulleys, rolling bodies, parallel rod of locomotive, hoisting in mines, and the like. Following these, the principles of work and energy are derived and emphasized in the study of problems involving fly-wheels and stationary engines, friction dynamometers, belting, trains and locomotives, and hoisting apparatus. The course is concluded by a short reading in the graphics of mechanisms.

Prerequisites: Courses III. and IV.
Mechanical Engineering V. or IX.

Texts: Church, *Mechanics of Engineering.*
Church, *Notes and Examples in Mechanics.*
Problem Sheets.
Cambria Steel.

Three hours per week during the second semester of the Junior year. (Allison.)

VI. ENGINEERING CONSTRUCTION.

In this course instruction is given in graphical analysis of the stresses in the more elementary forms of framed structures and a comparison is made with the algebraic solutions of the same problems. The student is required to make a close study of the force triangle, pole, ray, equilibrium polygon, resultant of forces, pier reaction, vertical dimensions of equilibrium polygons, together with the application

to simple beams, center of gravity, moment of inertia, articulated cranes, trusses, gallows frames and head frames. The course also embraces the computation of loads to be borne by frames, from the weights of parts and the elements involved. The student becomes familiar with the definitions of parts, such as housing, notching, mortise and tenon, dovetailing, lag-screws, dowels and lugs, and, from accepted unit stresses, the student is led to design joints, splices, deepened beams, trussed beams, gallows frames and head frames from wood. A brief study is made of the ordinary timbers used in construction and the best modern methods of protecting them from the action of the elements and wood destroying insects. Some attention is given to riveted and pin-connected trusses of steel.

Prerequisites: Mathematics, Courses I. to VII.
Mechanical Engineering, Courses I. to IV.

Texts: Ketchum. *Steel Mill Buildings.*
Miscellaneous references.
Lecture notes.

Lectures and recitations two hours per week and drafting three hours per week during the first semester of the Junior year. (Allison.)

VII. MILL CONSTRUCTION.

This course is a study of the theoretical and practical design of wooden and steel mill buildings and the uses of masonry in connection therewith. The general forms of such buildings are discussed and elementary ideas of ventilation, lighting, coverings, and the like are obtained. A wooden roof truss of accepted pattern is analyzed graphically and a detailed design, including roofing, rafters, purlins, upper and lower chords, struts, tie-rods, splices, corbels, anchorage, laterals, and miscellaneous joints, is completed.

Steel mill buildings are thoroughly discussed, an analysis of all stresses involved is obtained and a complete design is required from each student. A suitable amount of time is given to the study of the materials used in masonry con-

struction, such as brick, stone, lime, cement, plain and re-enforced concrete. A design of a dam, retaining wall, or foundation, is completed, together with estimates of quantities and cost.

Prerequisites: Courses III. IV. V. and VI.

Texts: Ketchum, *Steel Mill Buildings.*
Cambria Steel.
Miscellaneous references.
Lecture Notes.

Lectures and recitations two hours per week and design three hours per week during the second semester of the Junior year. (Allison.)

VIII. CEMENT LABORATORY.

The intent of this course is to so familiarize the student with the properties of cement that he may not hesitate to utilize this material in his professional work. The laboratory also provides extensive opportunities for research and investigation. The course covers tests for natural and Portland cement and cement mortars for tensile, crushing, and transverse strength, adhesion, soundness, fineness, setting, freezing, and effect of chemicals. The course also embraces the mixing of cement into mortar and concrete.

Prerequisites: Courses III. and IV.

Texts: *Seminary assignments to various works.*

Three hours per week during the first semester of the Senior year, in connection with Course X. (Hazard.)

IX. HYDRAULICS AND HYDRAULIC MOTORS.

The course deals with the theory and practical application of the properties of fluids at rest and in motion, embracing hydrostatic pressure, manometers, strength of pipes, pressures in tanks and against walls and dams; immersion and flotation; steady flow of liquids through pipes and orifices and over weirs; fluid friction and losses of head; time of emptying vessels; steady flow of water in open channels and Kutter's formula; impulse and resistance of fluids; pumps and rams; the Pelton water motor; overshot, breast

and undershot water-wheels; back water; theorem for flow in a revolving pipe; turbine and reaction wheels; theory of turbine testing.

Prerequisites: Courses III. IV. V. and VI.

Texts: Church, *Mechanics of Engineering.*
Church, *Hydraulic Motors.*

Three hours per week during the first semester of the Senior year. (Allison.)

X. HYDRAULIC LABORATORY.

Measurements are made of the flow over weirs, through orifices, and through flumes and ditches. The determination of the approximate law of flow in pipes also forms part of the course. Water-wheels are tested and the efficiency of the hydraulic ram under various conditions is determined.

Arrangements have been made by which this department has the use of the city water supply for experimental work with wheels and nozzles. This will make available a head of about twelve hundred feet. With the supply available for a few hours' work, tests may be made on wheels developing over three hundred horse-power.

Prerequisite: This course can be taken only in conjunction with Course IX.

Three hours per week throughout the first semester of the Senior year, in connection with Course VIII.

(Hazard.)

XI. CONTRACTS AND SPECIFICATIONS.

This course is given to familiarize the student with the forms and the legality of contracts, together with the parties having power to make them and to carry them out. The student also becomes acquainted with the common forms of specifications. A synopsis of the law of contracts is first taken up, dealing with competency; the agreement and its legality; the consideration; sealed and parole contracts; assignment; construction; subsequent changes, discharge and remedies for breach of contract. This is followed by a study of engineering specifications and accompanying documents dwelling upon advertising, instructions to bidders, forms of

proposals, general and specific clauses in engineering specifications, together with illustrative examples of complete contracts and specifications. Lectures by members of the legal and technical professions will also assist the student in more fully understanding the subject.

This course is intended only for regular Seniors but others may take it by special permission.

Text: Johnson, *Engineering Contracts and Specifications.*

Two hours per week during the second semester of the Senior year. (Allison.)

MECHANICAL ENGINEERING.

ASSISTANT PROFESSOR FRANK HOWARD CRONIN.

I. DESCRIPTIVE GEOMETRY.

This course begins with the fundamental problems on point, line, and plane and continues through shades and shadows, sections and projections of solids, isometric and horizontal projections, curved surfaces, intersections of solids and surfaces, and perspective.

Prerequisites: Entrance requirements.

Text: Low, *Descriptive Geometry, Parts I. and II.*

Two hours per week during the first semester of the Freshman year. (Burger, A. C. Smith.)

II. DESCRIPTIVE GEOMETRY DRAWING.

This work in the drawing room starts at the same time as the recitation work and is a direct application of the problems taken up in the recitation room.

Prerequisites: Entrance requirements.

Text: Low, *Descriptive Geometry, Parts I. and II.*

Six hours per week during the first semester of the Freshman year. (Cronin, A. C. Smith.)

III. ELEMENTARY MACHINE DESIGN.

Lectures and recitations on the principles underlying the design of machine parts and modes of motion. Special attention is paid to lettering and dimensioning of drawings.

Prerequisites: Courses I. and II.

Text: Reid, *Mechanical Drawing and Elementary Machine Design.*

Two hours per week during the second semester of the Freshman year. (Cronin.)

IV. ENGINEERING DRAWING.

The work in the drafting room is a direct application of the problems taken up in the lecture room. The aim of this course is to teach the proper way of making drawings for use in practice, good shop systems being adopted. Designs for screws, nuts and bolts are first taken up; then follow keys, cotters and gibs; rivets and riveted joints; shaft couplings and hangers; pipes and pipe couplings.

Prerequisites: Courses I. and II.

Text: Reid, *Mechanical Drawing and Elementary Machine Design.*

Nine hours per week during the second semester of the Freshman year. (Cronin, A. C. Smith.)

MINING ENGINEERING COURSES.

V. MACHINE DESIGN AND DRAWING.

Lectures and recitations on the different ways of transmitting power, including a close study of the best methods of determining what is required. Special attention is paid to the forces and stresses involved; all proportions of parts are analyzed and tested by the use of the mechanics of materials.

The work in the drafting room includes the design and layout of shafting; belt, cotton and manilla rope and wire rope drives; spur, bevel and friction gear drives, and variable speed devices.

Prerequisites: Courses I. to IV. inclusive.

This course must be taken in conjunction with or subsequent to Mechanics of Engineering.

Text: Low and Bevis, *A Manual of Machine Design and Drawing.*

Two hours lectures and six hours drawing per week during the first semester of the Junior year. (Cronin.)

VI. STEAM ENGINES AND BOILERS.

This course is especially designed for the needs of the mining engineering students. It includes a thorough investigation into the relative merits of the various types of

steam engines and boilers, together with the accessory apparatus, such as mechanical stokers, stacks, coal and ash-handling machinery, fuel economizers and feed-water heaters; condensers and cooling towers, piping, steam separators, traps, and lubrication.

The drawing room work includes the design of foundations, return tubular boiler and setting, self-supporting and guyed stacks, steam and water piping.

Prerequisite: Course V.

Text: Hutton, *Mechanical Engineering of Power Plants.*

Two hours lectures and six hours drawing during the second semester of the Junior year. (Cronin.)

VII. POWER PLANT DESIGN.

This course includes the assemblage of the apparatus treated specifically under Course VI. Special attention is paid to the selection of the best type and size of apparatus and arrangement according to the best practice. A design of a certain size power plant is drawn up, showing the principal apparatus installed. This includes a layout to scale of foundations, boilers, flues, and stack; pumps and feed-water heaters; engines and electrical machinery; steam and water piping; coal and ash-handling machinery.

Prerequisite: Course VI.

Text: Hutton, *Mechanical Engineering of Power Plants.*

Two hours lectures and six hours drawing per week during the first semester of the Senior year. (Cronin.)

VIII. MINE PLANT DESIGN.

Independent of thesis work, each student is assigned problems in design, organization, and installation of plants. Original design is encouraged but must be subordinate to the practice of leading machinery houses. All results are submitted according to approved business methods. Before attempting problems, students are required to familiarize themselves with equipment installed or in operation under similar conditions. Final results include working drawings, bills of materials, estimates, specifications, con-

tracts, a technical description of the plant, and a scheme for possible enlargement.

Prerequisite: Course VII.

One hour lecture and three hours drawing per week during the second semester of the Senior year.

(Young, Hoskin, Cronin, Allison.)

METALLURGICAL ENGINEERING COURSES.

IX. MACHINE DESIGN AND DRAWING.

This course for the metallurgical students has the same general outline as that for the mining students, but is more of an empirical nature. The work covers the study of engineering appliances rather than their design.

The work in the drafting room consists of laying-out shafting; belt, cotton rope, and manilla rope, and wire rope drives; spur, bevel and friction gear drives and variable speed devices. The work is, as far as possible, the application of apparatus to metallurgical operations.

Prerequisites: Courses I. to IV. inclusive.

This course must be taken in conjunction with or subsequent to Mechanics of Engineering.

Text: Low and Bevis, *A Manual of Machine Drawing and Design.*

One hour lecture and three hours drawing per week during the first semester of the Junior year. (Cronin.)

X. STEAM ENGINES AND BOILERS.

This course is especially devised to meet the needs of the metallurgical students. The work is of the same nature as that for the mining students.

The work in the drafting room consists of a design and setting for a return tubular boiler; design of furnaces, stacks and flues; methods of staying brickwork.

Prerequisite: Course IX.

Text: Hutton, *Mechanical Engineering of Power Plants.*

One hour lecture and three hours drawing per week during the second semester of the Junior year.

(Cronin.)

XI. POWER PLANT DESIGN.

This course consists of the design of a power plant; an assemblage of the more important apparatus taken up in Course X.

The drafting room work consists of laying out to scale foundations for machinery; boilers, flues and stacks; pumps and feed-water heaters; engines and electrical machinery; steam and water piping; coal and ash-handling machinery.

Prerequisite: Course X.

Text: Hutton, *Mechanical Engineering of Power Plants.*

One hour lecture and three hours drawing per week during the first semester of the Senior year.

(Cronin.)

XII. METALLURGICAL PLANT DESIGN.

The object of this course is to more thoroughly acquaint the student with the design and operation of apparatus and equipment for metallurgical plants than can be obtained from a lecture course alone. The lecture work includes a close study of the salient mechanical points of the design; the drafting room work includes the design and layout of reverberatory, roasting and smelting furnaces; concentrators and dryers; cyanide and chlorination mills. Before attempting problems, students are required to familiarize themselves with equipment installed and in operation under actual conditions. Working drawings, including bills of material, are submitted according to the most approved business methods.

Prerequisite: Course XI.

Text: *Trade Catalogues and Hand Books.*

Lecture one hour and drawing three hours per week during the second semester of the Senior year.

(Cronin, Traphagen, Haldane.)

XIII. COMPRESSED AIR MACHINERY.

A study of the machinery effecting the compression of air and the various machines using compressed air comprises the work of this course. The theory of the com-

pression and expansion of air is carefully considered before beginning the study of the air compressor. Single and multiple stage compressors, commonly used in mining districts, are then explained. Cooling and reheating, drying of air, and transmission of power by compressed air, together with a general resumé of the efficiency of compressed air, complete the first section of the course. Compressed air machinery, commonly used about mines, is then carefully studied. Among the types especially considered are hoists, pumps, locomotives, rock drills and coal cutters. The course concludes with a study of the efficiency, management, and methods of testing such machines.

Prerequisites: Either Course VI. or X.

Text: Richards, *Compressed Air.*

Two hours per week during the first semester of the Senior year. (Hoskin.)

XIV. GAS ENGINES.

This course comprises a study of the theory, construction, operation and efficiency of internal combustion engines. Special attention is given to the types of engines adapted to service in the arid and mountain regions and to underground conditions. The course concludes with a careful consideration of the management and testing of these machines.

Prerequisites: Either Course VI. or X.

Text: Lucke, *Gas Engine Design.*

Two hours per week during the first semester of the Senior year. (Hoskin.)

XV. PUMPING MACHINERY.

This course considers the pumping machinery adapted to mines and mills. It includes a careful study of the important types of steam, electric and compressed air pumps; of rotary and centrifugal machines; of valves and pump parts; and of the duty of pumps.

Prerequisites: Either Course VI. or X.

Text: *Trade Catalogues.*

Two hours per week during the second semester of the Senior year. (Hoskin.)

XVI. SPECIAL MINING MACHINERY.

This lecture course comprises a review of the various types of mining machinery already studied in Courses XIII. XIV. and XV, and a study of other machinery not included in preceding courses. Notable among such equipment are conveyors, dredges, ventilating machinery, tramways, electric hoists, loaders, and automatic devices for handling mine products. Models and working size examples of these machines are examined and explained, the machinery laboratory being equipped with actual machines such as are upon the market for the mining trade. Experiments are conducted to make the students familiar with the use of these machines. Manufacturers' catalogues are distributed, and the usual transactions and specifications involved in purchasing machinery are explained.

Prerequisites: Either Course VI. or X.

Text: *Trade Catalogues.*

Two hours per week during the second semester of the Senior year. (Hoskin.)

XVII. STEAM LABORATORY.

In this course, practical work is given in determining the power and efficiency of boilers, engines, and steam turbines. The values of various fuels, in boiler practice, are ascertained by systematic tests, and the student is required to find the economy possible in the use of feed water heaters, reheaters and cooling towers. Indicator cards are taken from engines and under different conditions of load, special attention being paid to the thermodynamics of steam. The testing of pressure gages and the setting of engine valve gears are among the experiments conducted.

Prerequisite: Either Course VI. or X.

Three hours per week during the first semester of the Senior year. (Hoskin.)

ELECTRICAL ENGINEERING.

ASSISTANT PROFESSOR WILLIAM JONATHAN HAZARD.

I. ELECTRIC POWER TRANSMISSION.

The object of this course is to familiarize the student with the practical applications of electricity and to enable him to make intelligent selection of apparatus found in the market which will best fulfil his requirements. It deals with the generation, measurement, transmission, and utilization of direct and alternating currents. The various systems of lighting are discussed. Direct and alternating current motors with their auxiliaries are studied in some detail to enable the user to adapt machines to altered conditions of use, where such changes are possible. Many problems are given to fix in the mind the principles studied. The course is given by text-book and lectures, supplemented by laboratory work and visits to various power plants.

Prerequisites: Physics I. to IV. inclusive.

Text: Franklin and Esty, *Elements of Electrical Engineering.*

Two hours per week throughout the Junior year.

(Hazard.)

II. ELECTRICAL LABORATORY.

This is the laboratory course accompanying Course I. It includes the calibration of voltmeters, ammeters and wattmeters, the measurement of the resistance of generators and motors, the determination of the range and capacity of rheostats for voltage and speed control, finding the saturation and characteristic curves and efficiencies of machines, determining the regulation and power factor of motors and the character of speed control by different systems.

Prerequisites: Physics I. to IV. inclusive.

Three hours per week during the first semester of the Junior year for the Metallurgical Engineering Course. and three hours per week during the second semester of the Junior year for the Mining Engineering Course. Also, six hours per week for the class during the Senior trip.

(Hazard.)

CHEMISTRY.

PROFESSOR HERMAN FLECK.
INSTRUCTOR CHARLES DARWIN TEST.
INSTRUCTOR JOHN CHRISTIAN BAILAR.

The courses in chemistry are arranged especially for the needs of the mining and metallurgical engineer. The demands made upon chemistry by these branches of engineering require a broad knowledge of inorganic chemistry, of the theories underlying the science, and a close acquaintance with the properties of the elements, their reactions, detection, and separation.

I. GENERAL CHEMISTRY.

The course begins with a historical sketch of the development of the science of chemistry up to the atomic era. Thereafter history is introduced only as occasion demands. While the course rests on a structure of inorganic chemistry, the development and application of modern theories and of organic chemistry are taught as the work advances through the non-metallic elements during the first semester. Simultaneously a closer inspection of these elements is offered in the laboratory.

Prerequisites: Entrance requirements.

Text: Richter, *Inorganic Chemistry.*

Four hours lectures and one hour recitation per week during the first semester of the Freshman year.

(Fleck.)

II. GENERAL CHEMISTRY.

The second semester proceeds with the metals, which follow in the order of their periodicity, the periodic law

having been previously expounded. Elementary metallurgy is introduced as the commercially important metals are considered.

Prerequisites: Entrance requirements.

Text: Richter, *Inorganic Chemistry.*

Four hours lectures and one hour recitation per week during the second semester of the Freshman year.

(Fleck.)

III. QUALITATIVE ANALYSIS. *Lectures.*

The course treats of the theory of qualitative analysis and of special methods of identification. The law of Mass Action and the Dissociation Theory are drawn upon for the former and standard works and current literature supply the latter.

Prerequisites: Entrance requirements.

Texts: Medicus, *Qualitative Analysis.*
Smith and Keller, *Experiments.*

Two hours per week during the first semester of the Freshman year. (Fleck, Bailar, Test.)

IV. QUALITATIVE ANALYSIS. *Laboratory.*

The course begins with a short review, in the laboratory, of the non-metals. The student, equipped with a working knowledge of experimental manipulation, undertakes the study of the reactions of the bases and their separation.

Prerequisites: Entrance requirements.

Texts: Medicus, *Qualitative Analysis.*
Smith and Keller, *Experiments.*

Nine hours per week during the first semester of the Freshman year. (Fleck, Bailar, Test.)

V. QUALITATIVE ANALYSIS. *Lectures.*

The course proceeds with the study of the metals, their detection and separation by special methods and dwells particularly upon correct interpretation of the reactions involved

and precautions necessary to obtain correct results. Details concerning the treatment of compounds, including minerals and mixtures, are entered into.

Prerequisites: Entrance requirements.

Text: Medicus, *Qualitative Analysis.*

Two hours per week during the second semester of the Freshman year. (Fleck, Bailar, Test.)

VI. QUALITATIVE ANALYSIS. *Laboratory.*

The practice of manipulation and study of the bases, their detection and separation are continued. The acids are then taken up and treated after the manner of the preceding. More complex substances are given for analysis and the decomposition and solution, and examination of refractory substances follow.

Prerequisites: Entrance requirements.

Text: Medicus, *Qualitative Analysis.*

Six hours per week during the second semester of the Freshman year. (Fleck, Bailar, Test.)

VII. QUANTITATIVE ANALYSIS.—*Lectures.*

(GRAVIMETRIC.)

The work of the first semester begins with a consideration of the theories of solution, electrolytic dissociation, and mass action as applied to analytical chemistry. The determination and separation of the elements and important radicals are considered in detail. The aim of the course is to study the general principles and methods of separation as used in quantitative analysis.

Prerequisites: Courses I. to VI. inclusive.

Text: Cairns, *Quantitative Analysis.*

One hour per week during the first semester of the Sophomore year. (Test.)

VIII. QUANTITATIVE ANALYSIS.—*Laboratory.*

(GRAVIMETRIC.)

The work begins with the analysis of simple salts. By this means the practice of manipulation and the observance

of necessary precautions are learned. Gradually the analyses of substances of more complex nature are introduced.

Prerequisites: Courses I. to VI. inclusive.

Text: Cairns, *Quantitative Analysis.*

Nine hours per week during the first semester of the Sophomore year. (Fleck, Bailar, Test.)

IX. QUANTITATIVE ANALYSIS.—*Lectures.*

(VOLUMETRIC.)

This course consists of a study of volumetric methods of analysis. First a consideration of the theory of indicators and methods of acidimetry and alkalimetry is taken up. Later the methods of the determination of the more important substances are studied, special attention being given to the principles of the methods used in smelter practice.

Prerequisites: Courses I. to VI. inclusive.

Texts: Bailar, *Laboratory Notes.*
Cairns, *Quantitative Analysis.*

One hour per week during the second semester of the Sophomore year. (Test.)

X. QUANTITATIVE ANALYSIS.—*Laboratory.*

(VOLUMETRIC.)

This course undertakes instruction in the use of standard solutions and a study of the reactions involved. In due time the methods commonly used in metallurgical industries are introduced. A knowledge of the preparation of standard solutions and their use is acquired by a course in acidimetry and alkalimetry. The preparation of standard solutions and their use in the wet assays of ores and products containing iron, manganese, lead, zinc, copper, and other metals are practiced.

Prerequisites: Courses I. to VI. inclusive.

Text: Bailar, *Laboratory Notes.*

Nine hours per week during the second semester of the Sophomore year. (Fleck, Bailar, Test.)

XI. TECHNICAL CHEMISTRY.

A broader acquaintance with industrial methods of chemistry, especially in the inorganic field, is an essential in the education of the engineer. The course is intended to supply this by illustrated lectures on chemistry applied to the arts and the apparatus used therein. Among the subjects considered are: acids, alkalis, chlorine and its products, potassium cyanide, explosives, bricks and other clay products.

Prerequisites: Courses I. and II.

Two hours per week during the first semester of the Sophomore year. (Bailar.)

XII. TECHNICAL CHEMISTRY.

The second semester continues with the following subjects; coal and its products, petroleum, cements, white lead, zinc-lead paint, the electric furnace and its products, and the technical extraction of the less common elements.

Prerequisites: Courses I. and II.

Two hours per week during the second semester of the Sophomore year. (Bailar.)

XIII. METALLURGICAL CHEMISTRY.

This course, essentially a laboratory course, embraces work requiring skill, accuracy, and experience acquired in the preliminary courses. The student performs operations which bring him into touch with the products of less common metallurgical processes, and also acquires a good idea of chemical practice used in conjunction with common metallurgical operations which he himself performs or observes. Naturally this adds to the knowledge, speed, and accuracy expected of him in actual practice. Among the tasks imposed are the estimation of arsenic, antimony, bismuth, nickel, cobalt, mercury, cadmium, tin, the examination of electrolytic slimes, the application of previously acquired knowledge in checking actual metallurgical operations and the study of electrolytic methods of analysis and of the more useful rare metals.

Prerequisites: Courses VII. VIII. IX. and X.

Six hours per week during the first semester of the Junior year. (Fleck.)

PHYSICS.

PROFESSOR EDSON RAY WOLCOTT.

In arranging the courses of this department the aim has been to make them as practical as possible, emphasizing those phenomena that bear directly on engineering problems, and yet not neglecting those facts which, though not so important of themselves, still are highly valuable in showing the close relationship that exists between physical laws. Special attention is given to problems involving the use of these laws, to actual demonstrations of their validity, and, as far as possible, to laboratory work verifying them quantitatively.

I. GENERAL PHYSICS.

This course consists of lectures, illustrated by experiment, and recitations with assigned problems. The subjects treated are as follows: mechanics, including the elements of kinematics, dynamics and hydrostatics; the properties of matter; heat, including thermometry and expansion, calorimetry, change of state, conduction, radiation, and the elements of thermodynamics; sound, including wave motion in general, production and propagation of sound waves, pitch, reflection, refraction, interference and resonance.

Prerequisites: Mathematics, Courses I. to IV. inclusive.

Text: Watson, *A Text-Book of Physics.*

This course must be preceded by or taken in conjunction with Mathematics V.

Three lectures and one recitation per week during the first semester of the Sophomore year. (Wolcott.)

II. GENERAL PHYSICS.

This course is a continuation of Course I. The subjects treated are as follows: light, including propagation, reflection, refraction, dispersion, interference, emission, absorption, and polarization; electricity and magnetism, including electro-statics, electro-kinematics, thermo-electricity, magnetic induction, electro-magnetism, electrolysis, the electro-magnetic theory, and electric oscillations.

Prerequisite: Course I.

This course must be preceded by or taken in conjunction with Mathematics VI. and VII.

Text: Watson, *A Text-Book of Physics.*

Three lectures and one recitation per week during the second semester of the Sophomore year. (Wolcott.)

III. PHYSICAL LABORATORY.

This course is arranged to accompany Course I. Its aim is to teach the student the necessity of careful work as well as to acquire skill in physical measurements so that the important physical laws can be quantitatively verified.

Prerequisites: Mathematics, I. to IV. inclusive.
Physics, I. must be taken in conjunction with this course.

Text: Ames and Bliss, *A Manual of Experiments in Physics.*

Three hours per week during the first semester of the Sophomore year. (Wolcott.)

IV. PHYSICAL LABORATORY.

This course is a continuation of Course III.

Prerequisite: Course III.

Physics II. must be taken in connection with this course.

Text: Ames and Bliss, *A Manual of Experiments in Physics.*

Three hours per week throughout the second semester of the Sophomore year. (Wolcott.)

MATHEMATICS.

PROFESSOR CHARLES ROLAND BURGER.
INSTRUCTOR ALWYN CHARLES SMITH.

The courses in this department have been arranged to meet the extensive needs of students in the various branches of engineering. The subjects are treated so as to give the student both logical training and power of application. The principles which are of greatest value in engineering work are particularly emphasized. The courses offered serve as a sufficient prerequisite for the work in mathematical physics, physical chemistry, engineering and applied mechanics; and they mark the minimum of mathematical attainments that an engineer ought to possess. A special feature of the work is the early introduction of the calculus. By this means the principles of this subject are allowed to develop slowly, their sphere of usefulness is widened, and the student is able, early in the course, to make direct application of his knowledge of mathematics to practical problems.

I. COLLEGE ALGEBRA.

This course begins with a comprehensive treatment of quadratics. The fundamental operations are constantly kept in mind and the student is drilled in the reduction of actual problems that come up later in his course. Graphic representation of equations is early introduced in the belief that the illumination which it affords greatly enlivens the entire presentation of the subject and brings algebra into closer relationship with the other mathematical courses. The progressions, inequalities, proportion, and variation, convergency and divergency of series, undetermined coefficients

with applications to partial fractions and expansion of functions in series, the binomial theorem, logarithms, exponentials, permutations and combinations, continued fractions, determinants and those propositions of the theory of equations that lead to the determination of the roots of numerical equations, are all amply treated.

Prerequisites: Entrance requirements.

Text: Hawkes, *Advanced Algebra.*

Five hours per week during the first semester of the Freshman year. (Burger, A. C. Smith.)

II. TRIGONOMETRY.

The general formulæ of plane and spherical trigonometry are developed. Much practice is given in the use of tables and the applications of trigonometry to mensuration in general. The astronomical triangle and such problems relating thereto as come up in surveying are dwelt upon particularly and graphic representation is given its needed emphasis.

Prerequisites: Entrance requirements.

Texts: Phillips and Strong, *Plane and Spherical Trigonometry.*

Vega, *Logarithmic Tables.*

Three hours per week during the first semester of the Freshman year. (Burger, A. C. Smith.)

III. ELEMENTS OF ANALYSIS.

This is a practical course in advanced algebra and in the elements of the differential calculus. The language, the symbols and the first processes of infinitesimal calculus, both in the pure and applied form, are explained. Many illustrations in geometry, physics, engineering, and applied mechanics are introduced. The fundamental principles of continuity, limiting values, theory of infinitesimals, and the differentation of the elementary forms are established. Application is made to problems involving maxima and minima, rates, and to theorems in analytic geometry. Many simple problems are frequently assigned to acquaint the student with the fundamental operations of the calculus.

Prerequisites: Courses I. and II.

Text: *Mimeographed Notes.*

Three hours per week during the second semester of the Freshman year. (Burger, A. C. Smith.)

IV. ANALYTIC GEOMETRY.

The analytic geometry of the straight line, circle and conic sections, including a discussion of the general equation of the second degree, is amply treated. Methods of the calculus are introduced. In the solid analytic geometry, besides the plane and the straight line, the cylinders and the surfaces of revolution are treated, and all the quadric surfaces are studied from the simplest forms of their equations.

Prerequisites: Courses I. and II.

Text: Bailey and Woods, *Analytic Geometry.*

Five hours per week during the second semester of the Freshman year. (Burger, A. C. Smith.)

V. DIFFERENTIAL AND INTEGRAL CALCULUS.

This course is a continuation of Course III. in which students are made familiar with the ordinary processes and applications of the calculus. A principal teature of this subject consists in carrying on the development of the differential and of the integral calclulus together. This method of instruction enables the student to grasp the more difficult notions of the subject in their inherent relations, and at the same time to apply this knowledge, early in the course, to the solution of engineering problems.

Prerequisites: Courses I. to IV. inclusive.

Text: Murray, *First Course in Infinitesimal Calculus.*

Five hours per week during the first semester of the Sophomore year. (Burger, A. C. Smith.)

VI. INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS.

This course is a continuation of Course V. The notion of a definite integral is stated in its fundamental and most

comprehensive form. The aim is to make clear the *rationale* of each process, and to encourage the student to become independent of formulæ of integration. The theory of single and multiple integration is applied to the principal methods of rectification and quadrature, and to the calculation of the surfaces and volumes of solids of revolution. The student is also given many useful and practical applications of the integral calculus. These include the general method to be employed in obtaining the position of a centroid, the value of a moment of inertia, and other practical problems in physics, engineering, and applied mechanics. For the sake of students in engineering, who wish to use differential equations and have little time to devote to general theory, the theoretical explanations are made as brief as is consistent with clearness and sound reasoning. Practical applications dealing with geometrical, physical, and mechanical problems are constant sources of discussion.

Prerequisites: Courses I. to V. inclusive.

Text: Murray, *First Course in Infinitesimal Calculus.*

Three hours per week during the second semester of the Sophomore year. (Burger, A. C. Smith.)

VII. THEORETICAL MECHANICS.

In this course prominence is given to those principles and results which the student finds to be a direct application of the theoretical mathematics and physics, as well as those that are of great importance in giving proper development and understanding for the work of mechanical engineering in the Junior year. Along with the analysis processes, graphical methods are introduced as aids to the understanding of the general principles. The course is intended to bridge the chasm between pure and applied mathematics.

Prerequisites: Courses I. to V. inclusive.

Text: Johnson, *Theoretical Mechanics.*

Two hours per week during the second semester of the Sophomore year. (Burger, A. C. Smith.)

INSPECTION TRIPS.

The same importance is attached to the inspection trips as to class room and laboratory work. Grades are given on reports submitted and satisfactory results are required for graduation.

MINING TRIPS.

Throughout the four years the classes make many trips to mines in order to see the varying practice and the operations and machinery described in the class room. The trips are planned to illustrate definite operations, to develop the power of observation and the ability to report concisely such observations. Each new student is encouraged to make a study of some district and, whenever possible during his college course, to apply principles, methods, and criticisms to that district.

During September and October, 1905, the Freshman class inspected the following in Gilpin County: Running Lode Mine, Gregory-Buell Mill, Rocky Mountain Concentrator, Bobtail Tunnel, Cook Mine, Boston and Denver Mill, Oldtown Mine, Ontario-Colorado Mine, La Crosse Tunnel, and Pewabic Consolidated Mines. During March, 1906, the Freshman Class inspected the following at Idaho Springs: Stanley Mine, Newhouse Tunnel, Central Tunnel, Shafter Mine, Consolidated Gem Mine and Miami Tunnel.

During March, 1906, the Sophomore Class inspected the following in the Cripple Creek District: Portland, El Paso, Vindicator, Elkton, Mary McKinney, Strong, and Abe Lincoln mines, and the Taylor and Brunton Sampler.

During the Junior year a trip to Leadville is made in order to illustrate practice in shaft sinking, tunneling, and hydraulic mining. Methods of mining and handling low-

grade ore are well illustrated on this trip. The equipment of mine plants is studied carefully, and available data are collected by each student in order to furnish practical examples in the study of mine plants during the Senior year.

METALLURGICAL TRIPS.

Immediately after taking up the study of metallurgy, trips extending throughout the Junior and Senior years are begun. These trips, intended to illustrate the lectures, are taken while the particular topics are under discussion, and tend to aid greatly in an appreciation of approved machinery and practice. By means of outlines furnished the student, which he is required to fill out, care is taken that all the important points in connection with each plant visited are studied and reported upon.

During the Junior year the following plants are visited:

The plant of the Denver Gas and Electric Company at Denver, for a general study of artificial fuels.

The Globe plant of the American Smelting and Refining Company at Denver, and the Independent Smelter at Golden, for a study of furnaces of various types.

The Minnequa plant of the Colorado Fuel and Iron Company at Pueblo, for a study of the manufacture of iron and steel and the working up of the product into commercial forms.

The Pueblo and Eiler's plants of the American Smelting and Refining Company, for a study of the metallurgy of lead.

The zinc plant of the American Smelting and Refining Company at Pueblo, and the plants of the Empire Zinc Company, and the United States Smelting Company at Canon City, for a study of the metallurgy of zinc.

During the Senior year the following plants are visited and reported upon:

The Jackson, Newton, Hudson, and other mills in Idaho Springs, for the study of ore dressing.

The various stamp mills of Black Hawk and Central City, for the study of amalgamation.

The Colorado Zinc Company and the Blake-Morscher works in Denver, for magnetic and electro-static separation.

The Boston and Colorado Company's plant at Argo, for the metallurgy of copper.

The cyanide mills of Idaho Springs, Colorado City, and Cripple Creek for the cyanide process.

The Portland and Standard mills at Colorado City, for the chlorination process.

POWER PLANT INSPECTION TRIPS.

At the close of the course in Electric Power Transmission a visit is made to several power plants, so that the apparatus studied in class can be seen in practical operation. Among these are the Clear Creek sub-station and the Platte street station of the Denver Tramway Company, and the West Side station of the Denver Gas and Electric Company. These plants are selected because of the representative apparatus in both direct and alternating current practice.

MINING MACHINERY TRIPS.

In order to become familiar with the structural features of the different machines commonly used in mining operations, occasional trips are made to Denver plants that manufacture or deal in mining machinery. Students are frequently permitted to take down and reassemble machinery and thus gain an intimate knowledge of the details not to be acquired in any other way. Among the houses visited are the following: The Hendrie & Bolthoff Manufacturing and Supply Company, The Colorado Iron Works Company, The Denver Engineering Works, Fairbanks, Morse & Company, and The J. George Leyner Engineering Company.

TECHNICAL CHEMISTRY TRIPS.

In connection with the course in Technical Chemistry inspection trips are made to the following: The Western

Flint Glass Company, The Denver Sewer Pipe Company, The Denver Stoneware Company, The Western Chemical Manufacturing Company, and The Golden Pressed and Fire Brick Company.

SENIOR TRIP.

At the conclusion of the Senior year an extended trip is made for advanced work in geology, metallurgy, and mining, to points in Colorado, Utah, Montana, and South Dakota. Illustrating lecture work in these subjects, this trip gives the prospective engineer a splendid opportunity to round out his collegiate work and enables him to get more closely in touch with actual practice. The points visited include Colorado Springs, Pueblo, Florence, Portland, Canon City, Leadville, and Aspen in Colorado; Bingham, Murray, Salt Lake, Park City, Eureka, Milford, Frisco, and Newhouse, in Utah; Butte and Anaconda, in Montana; and Deadwood, Terry, and Lead, in South Dakota.

In connection with so extensive a trip many and constant opportunities are given to study the relationship of geology to mountain formation and to physiographic forms. In addition to such general observation, special opportunities are given to study geological features in detail. This is especially true of the interesting geology of the Garden of the Gods at Manitou, and of the equally interesting problems involved in the ore deposits of Leadville, Aspen, Butte and other mining districts.

This trip coming, as it does, after the completion of all laboratory and lecture work in ore dressing and metallurgy affords a broader point of view than is possible at any other stage of the course. Advantage is taken of this condition to make a critical study of operations and plants, and in particular to study variations in treatment and general operation as affected by local surroundings. Comparisons of practices in different localities are carefully made, because the results of such study afford a basis for solving such problems of treatment as the student may meet in his professional practice.

Iron, copper, zinc and lead smelting may all be studied on the trip, as well as cyanidation and chlorination. Magnetic concentration and electro-metallurgy are important features and wet concentration as illustrated at Anaconda, Park City, and Aspen receives careful study. Metallurgically the trip is of great value and most of the important processes are shown under excellent conditions. From a mining standpiont the trip illustrates the economic mining and handling of low grade ores and especially the general design, equipment and organization of the mine plant. The special features include mining methods, pumping, and timbering at Leadville, mining methods and wire rope trams at Bingham and Park City; mine plant at Newhouse; and general mining practice and organization at Butte.

Detailed work is assigned each student according to his preference and there is a splendid opportunity to make a study of special conditions, operations, and machinery. The results of the student's investigations are carefully criticised and he is required to prepare a complete report on the trip.

BUILDINGS.

SIMON GUGGENHEIM HALL—Administration Building.

This building, the gift of Mr. Simon Guggenheim, of Denver, was erected and furnished at a cost of $80,000. The corner stone was laid by the A. F. and A. M. of Colorado, October 3rd, 1905. It is one hundred sixty-four feet long by fifty-seven feet wide and is surmounted by an ornate tower. The first floor is devoted entirely to the Department of Geology and Mineralogy, and includes lecture room, laboratory, office, two work rooms and public museum; the second floor contains the library, the office of the President, Secretary, and Registrar, the Faculty Room and the Trustees' Room; the third floor contains the Assembly Hall, two lecture rooms for mathematics and two offices, The building was dedicated October 17th, 1906.

HALL OF CHEMISTRY.

This is a continuous group of brick buildings, comprising the buildings of 1880, 1882, and 1890. The combined buildings of 1880 and 1882 contain the main chemical laboratories. In the building of 1890 are located the office and laboratory of the professor of chemistry, the chemical lecture room, the technical museum, two recitation rooms, the laboratories for gas and water analysis, the Freshman drawing room, and the gymnasium.

ASSAY BUILDING.

This building, a brick structure forty-six by ninety-two feet, was built in 1900 through funds contributed by the late W. S. Stratton, and enlarged in 1905 by an addition, to allow for the installation of a new equipment of furnaces of the gasoline type. The design and equipment of this building are such as to make it probably the best of its kind in the country.

HEATING, LIGHTING, AND POWER HOUSE.

The power plant recently erected at a cost of forty thousand dollars, was designed to furnish light, heat, and power to the entire school. It is a simple but artistic brick building, eighty-three by one hundred twenty-two feet, with concrete floors and tile roof. The building is divided lengthwise into an engine room thirty-four feet wide, and a boiler room forty-five feet wide. A conduit six feet wide and seven feet high surrounds the engine room below the floor and is used for steam and electric mains. A brick-lined steel stack one hundred twenty-five feet high carries all smoke to the upper air and away from the buildings. The end walls of the power house extend across a private alley and unite with the end walls of the Assay Laboratory, giving the two buildings a pleasing appearance of unity.

HALL OF ENGINEERING.

This building, constructed of red pressed brick, consists of two floors and a basement, and was completed in the fall of 1894. The upper floor contains the Junior and Sophomore drafting rooms, the blue print room, and a private office. The physics lecture and apparatus room, the photometry room, the physical laboratory, the balance room, and the apparatus rooms, as well as the private office, occupy the first floor. The basement contains the electro-metallurgical laboratory, three electrical laboratories, a battery and switchboard room, and a small shop.

STRATTON HALL.

The corner stone of this building was laid by the A. F. and A. M. of Colorado, on November 20, 1902, and was completed in January, 1904. The basement wall and first story are of Lyons sandstone, in broken ashlar, topped by a story of gray Golden brick. The building is finished on the interior with red pressed brick, and little wood is used, except that in the floors and staircases. The basement accommodates the metallurgical and ore dressing laboratories. The first floor contains two large lecture rooms, each with apparatus room and private office. The second floor, in

one-half, accommodates the surveying and mechanics in one large lecture room, with apparatus room and private office, and in the other half a drafting room. The third floor is devoted entirely to a large drafting room for the Senior class. The structure was named in honor of the late W. S. Stratton, whose gift of twenty-five thousand dollars made the building possible.

RESIDENCE OF THE PRESIDENT.

This is a brick building of two and one-half stories. It was built in 1888.

CARPENTER SHOP.

This is well equipped for the special demands which are continually arising in a technical school. The work varies from ordinary repair work to the careful construction of special apparatus needed in the various departments of the school.

MACHINE SHOP.

What has been said of the carpenter shop is equally true of the machine shop. It is imperative that the school have shops of its own, in order to keep its mechanical apparatus in proper working order, as well as to construct such apparatus as is necessary to carry on any new or original work. The machines of both shops are driven by direct connected motors.

LABORATORIES AND EQUIPMENT.

MINERALOGICAL AND GEOLOGICAL LABORATORY AND CABINET.

Under the name cabinet is embraced not only the distinctively display collections, which may perhaps be called the cabinet proper, but also the other collections that have been prepared mainly for the purpose of class instruction. These collections are necessarily changing rapidly from year to year, as new material is constantly being added. This new material is obtained partly by purchase, but mainly by direct collecting, and by means of exchange with other institutions. The display collections are not classified systematically, but are arranged in different cases with a view to displaying certain groups of minerals or minerals from certain localities. The display collections are to be found in flat glass-topped cases and the other collections in cases of drawers.

Among the more interesting displays are quartz and microcline crystals from Florissant, Colo.; golden calcites from Joplin, Mo.; fluorite and barite from England; epidote crystals from Alaska; pyroxene, epidote, and magnetite crystals from Salida, Colo.; sphalerite crystals from Kokomo, Colo.; pyrite crystals from Gilpin county, Colo.; crystallized sulphur from Sicily; dolomite and calcite from Ouray county, Colo.; geyserite from the Yellowstone National Park, and, above all, several cases of zeolites (thomsonite, mesolite, analcite, chabazite), from North Table Mountain, Golden, Colo. The case of mesolites is unique as well as beautiful, as it cannot be duplicated by any cabinet in the world.

The various collections are classified as follows:

FIRST. *A Mineral Type Collection*, consisting of well-characterized specimens to be used by the student for the

purpose of study and comparison. This collection at present contains specimens representing two hundred seventeen species and sixty one additional varieties. These specimens come from many countries, but Colorado minerals are especially well represented.

SECOND. *A Display Collection,* mainly ot large and fine specimens of minerals and rocks. Many graduates and mining men, friends of the institution, have contributed gifts to this collection.

THIRD. *A Supplementary Collection,* containing the rarer and more expensive minerals not placed in one of the above mentioned collections.

FOURTH. *A Descriptive Collection,* illustrative of the terms used in describing the various structural, physical, optical, and other properties of minerals.

FIFTH. *A Student's Working Collection of Minerals,* consisting of over twenty thousand unlabeled specimens, similiar to those in the type collection, to be used by the student for study and determination.

SIXTH. *A Crystal Collection,* consisting of natural crystals to be used in the determination of crystal forms.

SEVENTH. *A Crystal Model Collection,* containing a large number of glass and wooden models used in the study of crystallography.

EIGHTH. *A Blow-Pipe Collection,* containing materials used in blow-piping.

NINTH. *Rock Type Collection,* containing (a) a collection of rocks from different countries of the world; (b) a series of Colorado rocks; (c) various rocks illustrative of structural features.

TENTH. *A Working Rock Collection,* containing miscellaneous unlabeled rocks, to be used by students in connection with the study of lithology.

ELEVENTH. *A Collection of Fossils,* to be used in connection with the course in historical geology.

TWELFTH. The United State Geological Survey Educational Series of Rocks.

THIRTEENTH. Professor Patton's private collection of minerals.

FOURTEENTH. Professor Patton's private collection of rocks.

SUMMARY OF COLLECTIONS.

Type Collection of Minerals	3,700
Working Collection of Minerals (about)	21,000
Display Collection of Minerals	1,305
Supplementary Collection of Minerals	950
Crystal Collection	1,800
Display Collection of Fossils	342
Miscellaneous Collection of Fossils	1,360
Type Collection of Rocks	1,800
Working Collection of Rocks	7,408
United States Geological Survey Educational Series of Rocks	156
Professor Patton's Collection of Rocks	1,700
Professor Patton's Collection of Minerals	970
Summary of specimens	42,491

EXCHANGES.

The college has prepared a printed list of exchange material, covering both minerals and rocks. The list will be sent to all who wish to arrange for exchanges. Correspondents should state what material they are prepared to offer in exchange, and letters should be addressed to Professor H. B. Patton, Golden, Colo.

MINERALOGICAL LABORATORY.

Aside from the special advantages due to location the Department of Geology is admirably equipped for practical teaching. The entire first floor of Guggeheim Hall is occupied by this department. The south end of the building is occupied by a commodious lecture room, with a seating capacity of over a hundred, and by a separate mineralogical laboratory with table space for between fifty and sixty stu-

dents, also by two small recitation rooms. On the extreme north end of the building is the public museum, devoted to a display of fine minerals. Additional space is provided for working rooms, offices, packing, and storage rooms.

METALLURGICAL COLLECTIONS.

The college has the advantage of a fine collection of models from the works of Theodore Gersdorf, Freiberg, Saxony, illustrating the best type of furnaces in this and other countries. Each model is made to a scale and is complete in every detail. In addition to these models are the following illustrating the best modern practice:

Working model of twenty-stamp mill, on scale of one and one-half inches to the foot.

Working models of crushing rolls, same scale.

Working model of a Dodge crusher.

Model of modern blast furnace for lead-silver ores, with water-jacket.

There are also a large number of smaller models, such as the completed set used in the famous Keyes and Arents lead-well suit.

The collection of ores and metallurgical products is constantly being augmented.

METALLURGICAL LABORATORY.

This laboratory is equipped with apparatus for the study of the quantitative relations of the various agencies taking part in metallurgical changes.

The Junker, the Mahler Bomb. and the Parr calorimeters, the Wanner optical and the Le Chatelier electrical pyrometers together with sets of the American Gas Furnace Company's gas furnaces and Hoskin's gasoline furnace are used for securing the desired temperature for experimentation. These furnaces also serve for the necessary assaying demanded in the metallurgical laboratory. Desks and apparatus are provided for small scale work in amalgamation, chlorination, and cyanidation, while for larger scale work a battery for eight amalgamation pans, devised to be oper-

ated together or independently by power, several sets of cyanide tanks, including a Braun Laboratory Cyanide plant, and a chlorination barrel, are provided.

ORE DRESSING LABORATORY.

The equipment of the ore dressing laboratory, which is rapidly increasing, at present consists of the following apparatus: Sturtevant roll jaw crusher, Colorado Iron Works rolls, Forster crusher, Case crusher, Bosworth crusher, Vezin disc pulverizer, Braun's Perfection crusher, Braun's disc pulverizer, Braun's Chipmunk crusher, Braun's sampling machine, Denver Engineering Works Sample grinder, Wilfley table, Card concentrating table, accelerated pulsation jig, set of spitzkasten and all the necessary apparatus for systematic sampling of large and small parcels of ore.

For small scale work, Munroe's slime table, Vezin jig, Munro classifiers, and other devices, are supplied.

ELECTRO-METALLURGICAL LABORATORY.

The electro-metallurgical laboratory is located in the basement of the Hall of Engineering and includes, besides the main room, a room for the storage battery, a room for cleaning and polishing, and switchboard.

In the main room are located experimental tables with electrical connections and appliances for work in electro-chemical analysis and vats for the deposition and refining of metals. In any part of the room access to various sources of electrical energy is readily obtained by means of a central switch board.

ASSAY LABORATORY.

This laboratory is well equipped with parting, balance and store rooms and office, and has thirty-two coal-fired muffle furnaces. Each student has his own muffle, with his own coal bin, pulp balance, and desk, conveniently arranged with regard to his furnace; he has also access in the balance room to the best assay balances to be obtained on the market.

A recent addition to the building has increased the available furnace room by fifty per cent, and this added space has been utilized by the installation of an equipment of the most recent types of gasoline furnaces. The list includes, one crucible, four combination, three muffle furnaces, one crude oil burner, tempering furnace, a bullion and tempering furnace, all of the F. W. Braun & Co. type; also three Case muffle furnaces, and one Case crucible furnace, two Braun cupel machines, two Iler cupel machines and two Coronet rolls, one of which is of the Braun type. In order to avoid dust, change of temperature, and direct sunlight, the balance room has no outside walls, but is lighted by means of skylights. The equipment here includes six pulp balances, five silver, three gold balances, and one Thomson multiple rider balance. The variety of makers is as great as possible, so as to acquaint the student with the various mechanisms and adjustments in assay balances.

MINING LABORATORY.

Extensive additions have recently been secured for this laboratory, so that tests can now be made on a large number of the machines used in mines and in mine plants. A De Laval turbine direct-connected to two 37½ kilowatt Bullock generators is well arranged for providing practice in testing the efficiency of a steam turbine under varying conditions of load. There are also two working size models of the Bleichert system of aerial trams erected by the Trenton Iron Works Co. This equipment supplements the apparatus of the steam laboratory in providing a testing laboratory for mining machinery, but includes, as well, special equipment not found in the ordinary power plant. In this special equipment are included seven pumps, a two stage Leyner air compressor and rock drills of the following patterns: Box, Hardsocg, Ingersoll, Leyner, McKiernan, Shaw, Iler, and Wood. All the accessories necessary for the operation of these drills are provided as well as a complete equipment for the sharpening and tempering of drill steel.

MINING EQUIPMENT.

The mining equipment consists of models, maps, photographs, and lantern slides, illustrating mines and mining operations; safety lamps; instruments for measuring ventilation; an explosive tester; an electric firing apparatus, and models of timbering. The character of material mined is shown by an extensive collection of ores and rocks. Models of machinery and appliances, samples of rope, valves and injectors supplement the college power plant in illustrating the essentials of mine plants. Numerous reports on mines and plants have been collected to illustrate the practice of engineers and the economy in the operation of power machinery.

STEAM LABORATORY.

The Heating, Lighting, and Power Plant is well equipped for steam laboratory practice. New Babcock and Wilcox boilers, with automatic chain grates, are so set in units as to develop at pleasure 100, 200, or 300 horsepower. The steam generated supplies heat to all of the buildings and furnishes power for operating the machinery in the laboratories. There are also a fuel economizer, a superheater, a feed water heater, boiler feed pumps, eight 25 ton steel bunkers, coal track, ash conveyor and elevator. A tubular boiler and high speed automatic engine are used for testing purposes. There is also a fifteen horsepower throttling engine, and a small slide valve engine, which is used chiefly in illustrating valve setting. Calorimeters, measuring tanks, scales, various gages and gage testers, indicators, separators, traps, continuous counters, recording counters, speed indicators, injectors and other apparatus are included in the laboratory equipment.

PHYSICAL LABORATORIES.

The physical laboratories are located on the first floor and basement of the Hall of Engineering, and include, besides the lecture room and general laboratory, several special rooms fitted up with heavy piers for advanced work. The

equipment is arranged especially for the instruction of students of engineering, and includes, besides the ordinary demonstration and laboratory apparatus, a special apparatus for the determination of the mechanical equivalent of heat, the expansion of metals, the moment of inertia, the elastacity of metals by bending, twisting and stretching, and a complete Lummer-Brodhun photometer. The electrical laboratories are well equipped with galvanometers, standard resistances, condensers, ammeters, voltmeters, dynamometers, permeameters, standard cells and a Kelvin balance.

CEMENT LABORATORY.

The apparatus in this laboratory consists of a 1,200-pound Riehle testing machine for testing briquettes in tension. A nest of sand sieves gages the sand used in tests. Scales and volumeters are provided for measuring quantities in bulk. The specific gravity of cement is determined by means of Le Chatelier apparatus. A nest of fineness sieves and a very sensitive set of scales equip the student for the fineness test. Setting is determined by means of the complete Vicat apparatus. Trowels, spatulas, large slate mixing boards, beakers, moulds, and immersing vats, provide apparatus for the making and setting of briquettes and for the soundness tests. Glass baths for chemical tests, trays for heaviness tests, and other general facilities, permit the most extensive investigations.

TESTING LABORATORY.

The laboratory is provided with a motor driven 100,000-pound Riehle testing machine arranged for experiments in tension, compression, shearing, and flexure of materials of construction. Extensometers for measuring elongations and compressions are employed. Numerous steel sections provide useful problems in determining centers of gravity and moments of inertia. Experiments to determine the strength of threaded bolts, riveted joints and nailed joints are included in the course.

HYDRAULIC LABORATORY.

The hydraulic laboratory contains weirs and orifice tanks for the determination of coefficients of discharge, calibrated tanks for water measurement, a steel pressure tank for artificial heads, pumps for water supply and gages for pressure. A hydraulic ram is used to illustrate this class of apparatus and for testing. A long sheet iron trough, with a car over it is used for calibrating current meters. Water wheels and centrifugal pumps are tested for efficiency under various conditions of head and load. Hook gages are used for the accurate determination of low heads. Streams and ditches in the vicinity of Golden are gaged by means of the current meter, by rod floats, and by slope.

ELECTRICAL LABORATORY.

This laboratory is equipped with standard voltmeters, ammeters, and wattmeters, inductive and non-inductive resistances for artificial loads and a number of transformers.

The power equipment of the school available for laboratory work includes one 15 K. W. 150 volt compound wound direct current generator, one 1½ K. W. 125 volt shunt generator, one 2 K. W. 120 volt compound wound Brush incandescent light generator, one series arc light machine, one 30 K. W. 1100 volt compound wound 125 cycle single phase alternator, numerous constant speed and variable speed motors for direct current and a single phase induction motor.

In addition to the school current, the 60 cycle circuits of the Golden Illumination Company are available for power and light. From this source can be obtained voltages of 120, 250 and 2300, single or three phase.

CHEMICAL LABORATORIES.

The Freshman, Sophomore and Junior laboratories accommodate two hundred sixteen students, and are equipped with especially designed tile topped oak desks, provided with low reagent shelves, gas, water, filter pumps, and large procelain sinks. The balance rooms are equipped with

Sartorius, Becker, and Spoerhase balances. Gas is supplied to the building from a 300 light Detroit gas machine, which is connected with buried supply tanks outside the buildings. Good ventilation is obtained by means of two Sturtevant fans.

Research Laboratory. This laboratory is set apart for the needs of the department in its work of a research nature It is equipped with tile topped tables, ample hood space, gas, water, and electricity.

Gas Analysis Laboratory. Adjoining and communicating with the research laboratory, is placed the gas analysis laboratory. Throughout the day the room affords an even temperature and is well lighted. The tile topped table along the wall provides ample working space. Window space is reserved for a Lothar Meyer modification of the Bunsen eudiometer and a cathetometer. The laboratory also contains a complete Hemple and Elliott outfit, together with special apparatus for the collecting, storing, and handling of gases.

Water Analysis Laboratory. This laboratory adjoins and communicates with the gas analysis laboratory,and contains a full equipment of ordinary and special apparatus for water analysis. It is situated apart from the general laboratories and is particularly free from contaminating fumes.

SURVEYING EQUIPMENT.

The equipment of the department of surveying is well adapted to the practical course given. Students are organized into parties for field work. Each party is assigned instruments, rods, flags, steel measuring tapes, marking pins, hatchet, plumb bob, and other essentials are furnished from time to time as may be necessary. For transit work there are ten light mountain transits, six of which are provided with solar attachments for determining the meridian and latitude and eight of them are provided with auxiliary telescopes for underground work. There are also three heavy transits, one of which is of English and one of German make. In addition to the transits there is a plane table for taking topography.

For leveling, six wye levels of standard manufacture are used. The department is well supplied with leveling rods of various makes and types, stadia rods, hand levels, clinometers, flagpoles, and other accessories.

The instruments noted above are manufactured by such well-known firms as C. L. Berger and Sons, Buff & Buff, Heller & Brightly, Eugene Dietzgen & Co., Peter Heer & Co., W. and L. E. Gurley, Keufel and Esser, Wm. Ainsworth & Sons, Young and Sons, Negretti and Zambra (English) and Max Hildebrand (Freiberg, Germany). Additions are constantly being made, keeping pace with the growth of the school and replacing worn-out instruments.

DRAWING ROOMS.

FRESHMAN. This occupies the whole of the top floor of the Hall of Chemistry. The floor area is about four thousand square feet. It is lighted by windows on the north, east, and west, and by eight large skylights in the roof. A suitable office for the instructors is located in a central position, in which all drawings are filed and all records kept. Each student is provided with a drawing table, a drawer, a drawing board, and a stool. The present equipment will accommodate about one hundred twenty-five students.

JUNIOR. The second floor of the Hall of Engineering is used for the Junior drawing. There are two drawing rooms, each twenty-seven by fifty feet. They are lighted by windows on three sides and by skylights. Each student is provided with a drawing table, a drawer, a drawing board, and a stool. The tables are independent of each other and are adjustable. The present equipment accommodates about seventy-five students. There is a blue print room fully equipped with an adjustable printing frame and all other necessary appliances; also an office for the instructor, where all drawings and records are filed.

SENIOR. The drafting of the Senior year is given in the drafting room on the second floor of Stratton Hall.

TECHNICAL MUSEUM.

The Technical Museum is located on the first floor of the Hall of Chemistry. The object in establishing this museum is to aid in a practical way the courses in applied chemistry and metallurgy. Mounted specimens of raw materials, main products, by-products, and waste products of the various branches of technical chemistry and metallurgy are a direct stimulus in the study of these branches. The specimens already collected for the museum represent among other things, the various stages of the manufacture of brick; tile; cement; electrolytic alkalis; natural alkalis; electrolytic furnace products; carborundum; alundum; carbide; rare metals; ferro alloys and dye stuffs.

EXPENSES.

TUITION.

The Statutes of Colorado provide as follows:

> "The said School of Mines shall be open and free for instruction to all bona fide residents of this State, without regard to sex or color, and, with the consent of the Board, students from other states and territories may receive education thereat upon such terms and at such rates of tuition as the Board may prescribe."

The tuition for non-residents until the college year of 1908-9 is one hundred dollars per year. This is payable in two instalments—fifty dollars at the begining of each semester. For the college year beginning in September, 1908, and thereafter, the annual tuition will be one hundred fifty dollars, payable in two instalments—seventy-five dollars at the beginning of each semester. This increase in tuition does not apply to students entering the school and in regular attendance before the opening of the school year 1908-9.

FEES AND DEPOSITS.

Deposits are required to cover the cost of supplies consumed, and any unused balance is returned. Fees are charged to cover not only the cost of materials furnished, but also the wear on apparatus and supplies. No part of a fee is returnable.

Matriculation Fee (Paid once only)	$ 5.00
Locker Deposit (Paid once only)	1.00
Drawing Deposit (Paid once only)	2.00

FRESHMAN YEAR.

First Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Qualitative Analysis Fee	20.00
Qualitative Analysis Deposit	15.00

Second Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Qualitative Analysis Fee	20.00
Surveying Fee	5.00

SOPHOMORE YEAR.

First Semester.

Athletic Fee	$ 5.00
Quantitative Analysis Fee	10.00
Quantitative Analysis Deposit	15.00
Mineralogy and Blowpipe Fee	15.00
Physics Laboratory Fee	3.00
Surveying Fee	5.00

Second Semester.

Athletic Fee	$ 5.00
Quantitative Analysis Fee	10.00
Physics Laboratory Fee	3.00

JUNIOR YEAR.

First Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Assaying Fee (Mining Engineering only)	20.00
Assaying Deposit (Mining Engineering only)	25.00
Metallurgical Chemistry Fee (Met. Eng. only)	10.00
Metallurgical Chemistry Deposit (Met. Eng. only)	15.00
Testing Laboratory Fee (Met. Eng. only)	2.00
Electrical Laboratory Fee (Met. Eng. only)	2.00

Second Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Lithology Fee	3.00
Assaying Fee (Metallurgical Engineering only)	20.00
Assaying Deposit (Metallurgical Eng. only)	25.00
Testing Laboratory Fee (Mining Eng. only)	2.00
Electrical Laboratory Fee (Mining Eng. only)	2.00

SENIOR YEAR.

First Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Ore Dressing Fee	5.00
Ore Dressing Deposit	5.00
Electro-Metallurgy Lab. Fee (Metallurgical Engineering only)	5.00
Hydraulic Laboratory Fee	2.00
Cement Laboratory Fee	2.00
Steam Laboratory Fee (Min. Eng. only)	2.00

Second Semester.

Athletic Fee	$ 5.00
Drawing Fee	.50
Thesis Fee	5.00
Metallurgical Laboratory Fee	5.00
Metallurgical Laboratory Deposit	10.00
Metallurgical Practice Fee (Mining Engineering only)	5.00
Metallurgical Practice Fee (Metallurgical Engineering only)	10.00
Mining Laboratory Fee (Mining Engineering only)	3.00
Graduation Fee	6.00

TEXT BOOKS AND STUDENT SUPPLIES.

The cost of text-books and students' supplies necessarily varies, but the following is a fair estimate:

Freshman Year:	Text-Books	$28.00
	Drawing Supplies	20.00
Sophomore Year:	Text-Books	17.50
Junior Year:	Text-Books	24.25
Senior Year:	Text-Books	16.50

BOARD AND LODGING.

The college has no dormitory. Board can be obtained in private families at from four dollars to six dollars per week. Students' clubs furnish board at about fourteen dollars per month. Rooms can be obtained from six dollars to twelve dollars per month.

OTHER EXPENSES.

There are other expenses incidental to the mining, metallurgical, and geological trips, which vary so widely that they cannot be estimated. The preparation of the Senior theses also involves expenses which vary with the nature and treatment of the subjects. For laboratory work in special cases a deposit of fifteen dollars is required. Students leaving in mid-term, except on account of severe protracted sickness are not entitled to the return of fees or tuition. *All charges of the college are payable strictly in advance at the beginning of each semester.* No student is allowed to be graduated while indebted to the school. The Trustees reserve the right to make incidental charges in fees and deposits without printed notice, as new and unforseen emergencies may arise.

Students who desire to earn money to defray their college expenses are advised to limit their work to the summer vacation. The course of study is too exacting to allow much time during the college year for outside work.

The total expenses of the college year, exclusive of tuition, need not exceed four hundred dollars, and may, by strict economy, be considerably reduced.

GENERAL INFORMATION.

ATHLETIC ASSOCIATION.

By virtue of the athletic fee required of all students, all students regularly entering the School of Mines become members of the Athletic Association. The association is supported by the students' fees, by gate receipts, and by contributions from the alumni and other friends of the college. The treasurer of the school, Harry M. Rubey, Woods-Rubey National Bank, selected by the Board of Trustees is, ex officio, treasurer of the association. The affairs of the association are managed by a board of control, which consists of seven members, three undergraduates elected by the students, an alumnus selected by the alumni association, and three members of the faculty selected by the president of the school.

The Board of Control for 1906-7 is:
Professor H. B. Patton, President.
Professor Herman Fleck, Vice President.
G. S. Krueger, '07, Secretary.
Assistant Professor, W. G. Haldane.
W. B. Lewis, '92.
W. A. Jones, Jr., '08.
Forrest Mathez '09.

SPANISH.

In response to the demand from students who expect to pursue their vocation in Mexico, a private class in Spanish is conducted by Mrs. B. J. French.

METHODS OF GRADING.

The following system of grading is used:
A—Excellent.
B—Good.

C—Fair.
D—Conditioned.
E—Failed.

A, B and C are passing grades.

D (Conditioned) means that the student is not passed. The deficiency may be removed by passing an examination or otherwise completing his work. Unless a condition is removed before the beginning of the school year following the year in which the condition is given, it becomes an E, and the subject must be taken again.

E (Failed) means that the subject must be repeated and no advanced subject which depends on this one can be taken until the E is removed.

Y. M. C. A.

The association building is situated directly in front of the campus, at the corner of Cheyenne and Fourteenth Streets, where the association has its headquarters and where frequent social gatherings are held in its parlors. The aim of the association is to develop Christian character and high ideals of manhood in the student body. It has the cordial support of the president, the faculty, the trustees, and the citizens of Golden. During the year an employment bureau is maintained for the benefit of students who seek to help defray their college expenses. At the beginning of the school year a board and room bureau is conducted for the benefit of the incoming students. In connection with this a room mate bureau is also maintained.

The work of the association is under the immediate charge of the general secretary, Ray C. Roberts, formerly connected with the Y. M. C. A. at the University of Colorado, and a graduate of that institution. A hand book of information is published annually, a copy of which can be obtained upon application to the general secretary.

An advisory board, consisting of two members of the faculty, one minister, one business man, and an alumnus, has general supervision of the entire work.

Advisory Board—Prof. Horace B. Patton, Prof. William G. Haldane, Rev. William N. Friend, Judge Charles McCall, Arthur C. Terrill.

The officers of the Association are: C. E. Lesher, President; H. V. D. Hunt, Recording Secretary; A. R. Kenner, Treasurer; C. L. Colburn, Bible Study.

LIBRARY.

The Colorado School of Mines library numbers about eight thousand volumes and four thousand pamphlets, selected with special reference to the instruction given in the school. Students and faculty are allowed free access to the shelves, and may draw books, which are not reserved for a special purpose, for home use. The card catalogue is arranged on the dictionary plan, and the classification is an adaptation of the Dewey decimal system to the needs of a technical library.

The library receives the publications of the leading scientific societies of the world, and the chief library and scientific periodicals. It is especially rich in files of journals relating to the various branches of mining engineering, and receives as gifts the maps and various publications of the United States Geological Survey, a number of other United States documents, and reports of various state geological surveys and mining bureaus.

During the biennial period just closed, the library has received as gifts five hundred five volumes and nine hundred sixty-two pamphlets.

The library is open from 8 to 12 a. m., 1 to 5 p. m., and 7 to 10 p. m., with the exception of Sundays and holidays.

GYMNASIUM.

The gymnasium, located in the north end of the Hall of Chemistry, is a valuable adjunct to the equipment of the college. The floor space, sixty-five by forty feet without posts, permits drill exercises of large classes, while the height of twenty feet allows the use of swinging apparatus and perfect ventilation. Hot and cold shower baths adjoin the gymnasium.

SCIENTIFIC SOCIETY.

The Scientific Society of the Colorado School of Mines has for its object the presentation and discussion of technical and engineering subjects. Original papers are prepared and read before the society by its active members. The editorial staff has in operation a comprehensive system for the review of current technical literature and the bringing before the society of the noteworthy and salient questions of the day. The addressing of an assembly by the students insures the stimulation of confidence, which is so essential to the technical and professional man in his career. From time to time, lectures are delivered before the society by the leading authorities on various topics of primary interest to its members and friends. The proceedings of the society are printed in its official publication, "The Bulletin," which is issued twice during the school year. The Alumni, Faculty, Senior and Junior classes of the college constitute the active members of the organization, while the Sophomores and Freshmen are associates.

Meetings are held at least once a month, often more frequently, in Simon Guggenheim hall.

Officers for the year 1906-07 are:

C. G. Warfel, '07, President.

T. P. Ellis, '07, Vice President.

C. L. Colburn, '07, Secretary.

A. M. Nash, '07, Treasurer.

P. A. Gow, '07, Manager of the Bulletin.

Ward Blackburn, '08, Assistant Manager of the Bulletin.

H. C. Armington, '07, Editor of the Bulletin.

S. F. Cline, '08, Assistant Editor of the Bulletin.

SOCIAL CLUB.

Social life in the college is fostered by a regularly appointed body of students consisting of three members from each class. Several receptions during the year are given under their management.

Class of '07.

R. E. KNIGHT, President.
P. D. GROMMON, Vice President.
C. G. Warfel.

Class of '08.

R. B. Elder.
L. C. Page.
W. V. DE CAMP, Secretary and Treasurer.

Class of '09.

H. A. Kruger.
A. B. Crosley.
Paul Neer.

Class of '10.

T. M. Skinner, Jr.
T. T. Williams.
K. H. Matheson.

PRIZES.

The Mining Reporter of Denver, through W. F. R. Mills, Proprietor, offers annually a prize of fifty (50) dollars for excellence in Senior thesis work.

At the Annual Commencement in May, 1906, this prize was awarded to Max W. Ball and A. J. Koerner for their thesis on the "Quartzite Area of Coal Creek, Jefferson County, Colorado."

A. B. Frenzel annually offers one hundred fifty (150) dollars in prizes for excellence in the Department of Geology and Mineralogy and for Senior theses. At the Annual Commencement in May, 1906, these prizes were awarded as follows:

R. G. Bowman, $25.00 for excellence in Crystallography and Mineralogy.

A. G. Wolf, $25.00 for excellence in General Geology and Lithology.

C. Q. Schlereth, $25.00 for excellence in Economic Geology.

W. S. Kell, K. E. Neugebauer, C. Q. Schlereth, $75.00 for the Senior thesis on Uranium.

Mr. D. W. Brunton, of Denver, offers a Brunton Mining Transit for the best Senior thesis on any subject in which surveying forms a necessary part.

Mr. Frank Bulkley, member of the Board of Trustees, offers a prize of one hundred (100) dollars for the best Senior thesis involving the report on a mining property.

Mrs. Edward G. Stoiber offers a prize of two hundred (200) dollars, to be known as the "Edward G. Stoiber Prize Fund," in memory of her late husband, Mr. Edward G. Stoiber, for the best Senior thesis or theses involving the concentration of ores and the separation of metals.

ALUMNI ASSOCIATION.

The Association of the Alumni of the Colorado School of Mines holds its annual meeting and banquet on the day following the commencement exercises, unless otherwise provided by the Executive Committee.

All graduates holding degrees are eligible to membership, and are invited to the annual meeting and banquet.

The aim of the Association is to promote acquaintance and friendship among the graduates, to encourage them to aid each other, and to make an organized effort to elevate and uphold the reputation and standard of their Alma Mater.

All graduates are earnestly requested to join the organized body and to keep the Secretary advised as to their addresses.

The officers of the Association are:

H. A. CANNING, '97, President.

O. R. WHITAKER, '98, Vice President.

J. H. STEELE, '00, Secretary,

P. O. Box 236, Denver, Colo.

C. L. DAVIS, '99, *Treasurer.*

G. B. PUTNAM, '05; E. E. ROWE, '95; W. H. PAUL, '95, Executive Committee.

GIFTS TO THE COLLEGE.

ACHESON GRAPHITE COMPANY, Niagara Falls, N. Y.
Specimens of products.

PITTSBURG REDUCTION COMPANY, Pittsburg, Pa.
Samples of Carborundum products.

CROCKER-WHEELER ELECTRICAL COMPANY, Denver, Colo.
475 blue prints; pictures of motors and generators.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y.
Case of incandescent lamps, illustrating the different stages of manufacture.
Picture of steam turbine and generator.

WESTERN ELECTRIC COMPANY, Chicago, Ill.
Collection of insulated wire and cable samples.

UNION CARBIDE COMPANY, Niagara Falls, N. Y.
Collection of products.

THE LUNKENHEIMER COMPANY, Cincinnati, Ohio.
Sectioned samples of regrinding globe valve, injector, gate valve and senior lubricator.

NERNST LAMP COMPANY, Pittsburg, Pa.
Nernst Lamp.

FARBENFABRIKEN OF EBENFELD CO., New York.
Samples of coal-tar dyes.

NORTON EMERY WHEEL COMPANY, Worcester, Mass.
Twenty samples of products.

H. A. METZ, 122 Hudson St., New York.
Samples of coal-tar dyes.

MAX BOEHMER, Mining Engineer, Denver, Colo.
Model of mine.

DR. HERMAN FLECK, Golden, Colo.
Bucking board and muller for Assay Laboratory.

ROBINS CONVEYING BELT COMPANY, New York.
Samples of conveying belt.

NEW YORK CENTRAL AND HUDSON RIVER R. R.
Four pictures of the New York Central Lines.

PRIMOS CHEMICAL COMPANY, Primos, Pa.
Cabinet of rare metals. Tungsten metal.

WARREN BROTHERS COMPANY, New York.
Samples of biluthic pavement.

DEUTSCHE UNTERRICHTS AUSSTELLUNG, Louisiana Purchase Exposition.
Collection of fine and rare chemicals.

GERMAN POTASH SYNDICATE, Strassfurt, Germany.
Samples of raw and finished products.

HENDRIE & BOLTHOFF MANUFACTURING CO., Denver, Colo.
Picture of Murray Corliss engine.
Picture of Marsh general service pump.
Card Concentrating Table.

THE W. S. TYLER COMPANY, Cleveland, Ohio.
Sample board of wire cloth and mining screens.

RAPID-ECONOMY STAMP MILL COMPANY, San Francisco, Cal.
Model of Richards Rapid-Economy stamp mill.

THE BROWN HOISTING MACHINERY COMPANY, Cleveland, Ohio.
Four pictures of industrial plants.

KUEFFEL AND ESSER, New York.
Large slide rule.

FLINT-LOMAX ELECTRICAL AND MANUFACTURING COMPANY, Denver, Colo.
Standard test specimens in cast aluminum and bronze.

UNIVERSITY OF PENNSYLVANIA ALUMNI.
Set of University views.

PORTLAND CEMENT COMPANY, Portland, Colo.
Cement for cement laboratory.

A. W. FABER COMPANY, New York.
Large slide rule.

WESTERN CEMENT SELLING COMPANY, Denver, Colo.
Iola cement for cement laboratory.

AMERICAN GAS FURNACE COMPANY, New York.
Two assay cupel furnaces.
One Reichhelm pressure blower.
One smelting furnace.
Four muffles.

F. W. THOMPSON, Denver, Colo.
One Thompson Multiple Rider Carrier.

HAMMON AND MARTIN, Ouray, Colo.
One Martin automatic plumb bob.

WILLIAM HOSKINS AND COMPANY, Chicago, Ill.
One gasoline furnace.

JENKINS BROTHERS, Chicago, Ill.
Assortment of globe valves, pump valves, discs, packing, check valves, and gasket tubing.

THE LUNKENHEIMER COMPANY, Cincinnati, Ohio.
Sectioned paragon lubricator, Mars lubricator, and rotary gauge cock.

GENERAL ELECTRIC COMPANYY, Schenectady, N. Y.
Framed pictures of the Schnectady works and of the N. Y. C. 100-ton 3000 H. P. Electric Locomotive.

MORSE BROTHERS MACHINERY AND SUPPLY COMPANY, Denver, Colo.
Model of Corliss engine.

ALLIS-CHALMERS COMPANY, Chicago, Ill.
Six framed pictures: "Big Reliable" engine and generator; connecting rod shops; Manhattan Railway bridge; lead furnace; Overstorm table; and Gates rock and ore breaker.

WESTERN VALVE COMPANY, Chicago, Ill.
Assortment of sectioned valves; ordinary and flanged coupling.

PROF. C. W. L. FILKINS,
Five photograph printing frames.

THE BLAISDELL COMPANY, Los Angeles, Cal.
Pictures of excavators at the El Oro Mining and Railway Company, El Oro, Mexico.

THE HANCOCK INSPIRATOR COMPANY, Chicago, Ill.
One sectioned Hancock Inspirator.

THE WESTINGHOUSE COMPANY. Pittsburg, Pa.
Five pictures of Westinghouse installations

E. P. ARTHUR, Cripple Creek, Colo.
Mining map of Cripple Creek District.

CASTNER-ELECTROLYTIC ALKALI COMPANY, Niagara Falls, N. Y.
Samples of chemical products.

JUDGE N. F. CLEARY, New York, N. Y.
Model of El Panuco Mine, Coahuila, Mexico.

JOSEPH T. RYERSON & SON, Chicago, Ill.
Model of Morrison corrugated boiler.

DETROIT LUBRICATOR COMPANY, Detroit, Mich.
One standard lubricator.

AMERICAN LUBRICATOR COMPANY, Detroit, Mich.
One U. S. automatic injector.

D. W. BRUNTON, Denver, Colo.
One Brunton Pocket Transit.

BULLOCK ELECTRIC MFG. COMPANY, Cincinnati, Ohio.
Sample board of construction parts.

WATSON AND MCDANIEL COMPANY, Philadelphia, Pa.
One McDaniel Improved Steam Trap.

JEFFERY MANUFACTURING COMPANY, Columbus, Ohio.
Three framed pictures of rock drills.

DENVER FIRE CLAY COMPANY, Denver, Colo.
Four Case gasoline furnaces.
One Iler cupel machine.

CHAPMAN VALVE MANUFACTURING COMPANY, Indian Orchard, Mass.
Four sectioned valves.

UNION PACIFIC RAILROAD COMPANY.
Six framed pictures.

MCKIERNAN DRILL COMPANY, New York, N. Y.
One rock drill with column.

HARDSOCG WONDER DRILL COMPANY, Ottumwa, Iowa.
Rock drill, with column and bits.

EDWARD G. STOIBER, Denver, Colo.
One Hildebrand mining transit.

COLORADO MIDLAND RAILWAY COMPANY.
Two framed pictures.

NEW YORK BELTING AND PACKING COMPANY, New York, N. Y.
Samples of packing and belting.

CHICAGO AND NORTHWESTERN RAILWAY COMPANY.
Five framed pictures.

AMERICAN STEAM PUMP COMPANY, Battle Creek, Mich.
Three valves.
Sectioned pump.
One framed picture.

HOTEL COLORADO, Glenwood Springs, Colo.
One framed picture.

WISCONSIN BRIDGE AND IRON COMPANY, Chicago, Ill.
Blue prints of coal tipples.

GARLOCK PACKING COMPANY, Denver, Colo.
Wall cabinet of various packings.

C. H. SHAW PNEUMATIC TOOL COMPANY, Denver, Colo.
One rock drill complete.

WESTON ELECTRICAL INSTRUMENT COMPANY, Newark, N. J.
Exhibition case of parts.

CHICAGO, BURLINGTON AND QUINCY R. R. Co.
Two framed pictures.

A. E. LINDROOTH, SHUBART AND COMPANY, Denver, Colo.
Four framed pictures from the Goodman Mfg. Co.
Two framed pictures from the Ridgway Dynamo and Engine Company.
One framed picture from the Link-Belt Machinery Co.

THE J. GEORGE LEYNER ENGINEERING COMPANY, Denver, Colo.
One 12x14 two-stage air compressor.

THE TRUAX MANUFACTURING COMPANY, Denver, Colo.
John T. Plummer, Prop.
Truax Patent Automatic ore car.

SULLIVAN MACHINE COMPANY, Chicago, Ill.
One air drill, complete.

THE BABCOCK AND WILCOX COMPANY, New York, N. Y.
Six framed pictures.

CONTINENTAL COLOR AND CHEMICAL COMPANY, New York, N. Y.
Samples of colors.

KEASBEY AND MATTISON COMPANY, Amber, Pa.
Case of samples.

JONES AND LAUGHLIN STEEL COMPANY, Pittsburg, Pa.
William C. Moreland, Sec'y.
Three framed pictures.

INGERSOLL-RAND COMPANY, New York, N. Y.
One Ingersoll-Sergeant drill, complete.

TRENTON IRON WORKS, Denver, Colo.
Col. R. D. Seymour, General Agent.
Aerial tram.

WABASH RAILROAD,
P. Hitchcock, General Agent.
Framed picture.

COLORADO BUREAU OF MINES,
E. L. White, Commissioner.
Five cases for minerals.

JOHN W. FINCH, State Geologist, Denver, Colo.
Mine model.

DENVER, NORTHWESTERN AND PACIFIC RAILWAY.
Pictures of scenery on the Moffat Road.

HARRY M. RUBEY, Golden, Colo.
Mounted eagle.

RAND-INGERSOLL COMPANY, New York, N. Y.
Temple-Ingersoll electric drill.

MR. SIMON GUGGENHEIM, Denver, Colo.
"Mucho Quidado," oil painting by John A. Howland.

T. DWIGHT SMITH, Denver, Colo.
Native Copper and Cylindrite.

THOS. F. DALY, Denver, Colo.
Twenty photographs of the Calumet and Hecla mining properties.

JOHN GEISEL, Denver, Colo.
Fluorite Crystals.

CHAS. J. ADAMI, Butte, Montana.
Copper ores from the Gagnon mine.

WILLIAM WATSON, Denver, Colo.
Collection of ores and minerals.

FRED E. FIELD, Beatty, Nevada.
Ruby silver.

ENROLMENT OF STUDENTS.

CLASS OF 1907.

SENIORS.

OFFICERS.

President, C. G. WARFEL.
Vice President, A. G. WOLF.
Secretary, PIERCE BARKER.
Treasurer, R. E. KNIGHT.

	Course	
Armington, H. C.	Min.	*Leadville, Colo.*
Barker, Pierce	Met.	*Philadelphia, Pa.*
Bastanchury, G. A.	Min.	*Fullerton, Cal.*
Brandt, A. R.	Min.	*Denver, Colo.*
Colburn, C. L.	Min.	*Denver, Colo.*
Corson, N. G.	Min.	*Del Norte, Colo.*
Ellis, T. P.	Min.	*Denver, Colo.*
Emens, R. B.	Met. & Min.	*Victor, Colo.*
Filteau, C. A.	Min.	*Idaho Springs, Colo.*
Friedhoff, W. H.	Met. & Min.	*Denver, Colo.*
Geisel, C. R.	Min.	*Denver, Colo.*
Golden, J. P.	Min.	*O'Neill, Neb.*
	B. S. University of Nebraska.	
Gow, P. A.	Min.	*Golden, Colo.*
Grommon, P. D.	Met.	*Denver, Colo.*
Hills, L. P.	Min.	*Durango, Colo.*
	B. S. Ohio Wesleyan University.	
Hollis, D. D.	Min.	*Silverton, Colo.*
Howat, A. M.	Min.	*Salt Lake, Utah*
Isom, E. W.	Min.	*Chicago, Ill.*
Kenner, A. R.	Min.	*Kenilworth, Il.*
	Armour Institute of Technology.	
Knight, R. E	Met.	*Denver, Colo.*
Krueger. G. S.	Min.	*Longmont, Colo.*
Lannon, F. P., Jr.	Met.	*Pueblo, Colo.*
Martin, J. A.	Min.	*Golden, Colo.*
Moore, C. F.	Min.	*Denver, Colo.*

	Course	
Moore, G. P.	Min.	*Winsted, Conn.*
Nash, A. M.	Min.	*Golden, Colo.*
	B. S. Kansas State Agricultural College.	
Norton, A. C.	Min.	*La Junta, Colo.*
Parsons, F. H.	Min.	*Paterson, N. J.*
	A. B. Wesleyan University.	
Phelps, W. B.	Min.	*Los Angeles, Cal.*
	B. S. St. Vincent College.	
Quayle, T. W.	Met.	*Denver, Colo.*
Ross, G. M.	Met.	*Golden, Colo.*
Shaver, F. J.	Min.	*San Jacinto, Cal.*
Stotesbury, H. W.	Min.	*Leadville, Colo.*
Warfel, C. G.	Min.	*Golden, Colo.*
White, J. L.	Met. & Min.	*Denver, Colo.*
Wolf, A. G.	Min.	*Golden, Colo.*

CLASS OF 1908.

JUNIOR.

OFFICERS.

President, R. B. ELDER.
Vice President, I. J. DILTS.
Secretary, C. E. LESHER.
Treasurer, R. M. WHEELER.

	Course	
Adams, J. H.	Met.	*Steamboat Springs, Colo.*
B. S. Ag. and Mech. College, Oklahoma; A. B. University of Kansas.		
Anfenger, M. B.	Min.	*Denver, Colo.*
Blackburn, Ward	Min.	*Denver, Colo.*
Block, G. E.	Min.	*Prescott, Ariz.*
Boyd, J. T.	Min.	*Denver, Colo.*
Brinker, A. W.	Min.	*Denver, Colo.*
Brown, C. L.	Min.	*Golden, Colo.*
Brugger, A. E.	Met.	*Columbus, Neb.*
University of Michigan.		
Bryan. R. R.	Met.	*Denver, Colo.*
Buell, A. W.	Min.	*Evergreen, Colo.*
Chedsey, W. R.	Min.	*Denver, Colo.*
Clapp, L. P.	Min.	*Denver, Colo.*
Worcester Polytechnic Institute.		
Cline, S. F.	Min.	*Mansfield, O.*
Leland Stanford Jr. University.		
Crawford, W. O.	Min.	*Santa Monica, Cal.*
Curtis, L. P.	Min.	*Littleton, Colo.*
De Camp, W. V.	Min.	*Denver, Colo.*
Dilts, I. J.	Met.	*Ft. Collins, Colo.*
Doyle, D. B.	Min.	*Pittsburg, Pa.*
A. B., A. M., Princeton University.		
Dunlevy, F. S.	Met.	*Denver, Colo.*
Elder, R. B.	Met.	*Denver, Colo.*
Ellsworth, A. C.	Min.	*Chicago, Ill.*
B. S. University of Chicago.		
Evans, Willis	Met.	*Golden, Colo.*
Everest, H. A.	Min.	*Oklahoma City, Okla.*
B. S. University of Oklahoma.		
French, B. J.	Min.	*Golden, Colo.*
A. B., University of Denver.		

Cours

French, Sidney W. ....Met. .....*Denver, Colo.*
Frick, F. F. .....Met. ..... *Peru, Indiana*
Goe, H. H. .....Met. ..... *Colorado Springs, Colo.*
Hammond, H. W. .....Min. ..... *Syracuse, N. Y.*
Leland Stanford Jr. University.
Harris, Morrison .....Min. ..... *Philadelphia, Pa.*
B. S. in C. E., University of Pennsylvania.
Holderer, G. B. .....Min. .....*Denver, Colo.*
University of Denver.
Houseman, E. G. .....Min. ..... *Grand Rapids, Mich.*
A. B., University of Michigan.
Hubbard, J. V. .....Min. ..... *Golden, Colo.*
Hull, C. B. .....Met. ..... *Idaho Springs, Colo.*
Hunt, H. V. D. .....Met. ..... *Baltimore, Md.*
Baltimore Polytechnic Institute.
Hynes, B. D. .....Min. ..... *Elgin, Ill.*
B. S., Virginia Polytechnic Institute.
Ireland, C. B. .....Met. & Min. .....*Golden, Colo.*
Jacques. H. L. .....Met. .....*Denver, Colo.*
Johnson, B. M. .....Met. & Min. ..... *Denver, Colo.*
University of Minnesota.
Johnston, W. M. .....Met. & Min. .....*Pensacola, Fla.*
Hamline University.
Jones, I. P. .....Min. ..... *Naco, Ariz.*
Armour Institute of Technology.
Jones, W. A., Jr. .....Min. .....*Ware Neck, Va.*
Princeton University.
Kilgour, M. H. .....Min. ..... *London, Eng.*
Central Technical College, London, Eng.
Knight, H. G. .....Met. ..... *Akron, O.*
B. S., Buchtel College.
Knowles, B. W. .....Min. .....*Denver, Colo.*
Langrall, C. A. .....Met. ..... *Baltimore, Md.*
Baltimore Polytechnic Institute.
Lesher, C. E. .....Met. ..... *La Junta, Colo.*
Lewis, W. M. .....Met. ..... *Georgetown, Colo.*
University of Minnesota.
Link, K. G. .....Met. .....*Denver, Colo.*
Lowell, J. B. .....Met. ..... *Worcester, Mass.*
Worcester Polytechnic Institute.
Lyon, C. A. .....Min. ..... *Newark, N. J.*
A. B., Princeton University.
Macbeth, Gordon F. ....Min. .....*Denver, Colo.*
Ph. B., Sheffield Scientific School.
Maddux, R. H. .....Min. ..... *Golden, Colo.*
Murch, C. H. .....Min. .....*Denver, Colo.*
University of Denver.
Nevin, B. .....Met. ..... *Porto Rico*
Brooklyn Polytechnic Institute.
Page, L. C. .....Min. ..... *Norfolk, Va.*

	Course	
Reno, C. A.	Min.	*Manitou, Colo.*
Roberts, R. C.	Min.	*Boulder, Colo.*
	B. S., University of Colorado.	
Root. C. D.	Min.	*Denver, Colo.*
Sandusky, S. C.	Met. & Min.	*Salida, Colo.*
Schoeller, W. R.	Min.	*Antwerp, Belgium*
	University of Greifswald, Germany.	
Taylor, R. M.	Min.	*Golden, Colo.*
Vinal, E. L.	Met. & Min.	*Denver, Colo.*
	University of Minnesota.	
Waite, J. W.	Min.	*Denver, Colo.*
	Ph. B., Adelbert College.	
Weinig, A. J.	Met.	*Durango, Colo.*
	University of Colorado.	
Wheeler, R. M.	Min.	*Denver, Colo.*
	University of Denver.	
White, D. A.	Met.	*Chicago, Ill.*

CLASS OF 1909.

SOPHOMORE.

OFFICERS.

President, H. A. KRUEGER.
Vice President, PAUL NEER.
Secretary, V. H. WHIPPLE.
Treasurer, J. J. WEISZ.

Allen , L. M., Jr. ..... *Westwood, N. J.*
Babson, G. L. ..... *Seward, Neb.*
University of Nebraska.
Baker, M. H. ..... *Denver, Colo.*
Benjovsky, T. ..... *Del Norte, Colo.*
Bennitt, J. S. ..... *Jersey City, N. J.*
Stevens Institute of Technology.
Bradford, A. H. ..... *Placentia, Cal.*
Bradford, J. S. ..... *Denver, Colo.*
Brigham, E. D., Jr ..... *Glencoe, Ill.*
Sheffield Scientific School. Yale University.
Brueggemann, F. ..... *Denver, Colo.*
Brunton, F. K. ..... *Denver, Colo.*
University of Wisconsin.
Bunger, M. E. ..... *Edgewater, Colo.*
University of Denver.
Canning, W. E. ..... *Council Bluffs, Ia.*
Carpenter, C. H. ..... *Denver, Colo.*
University of Denver.
Chambers, Horace ..... *Nashville, Tenn.*
Crosley, A. B. ..... *Denver, Colo.*
Darroch, J. I. ..... *Livingston, Mont.*
Donaldson, John ..... *Minneapolis, Minn.*
Massachusetts Institute of Technology.
Dyer, C. E. ..... *Golden, Colo.*
Emrich, C. T. ..... *Golden, Colo.*
Colorado College.
Enriquez, E. W. ..... *Chihuahua, Mexico*
Notre Dame University.
Feldman, S. A. ..... *Denver, Colo.*
Ferris, H. A. ..... *Aspen, Colo.*
Fitz Gerald, R. P. ..... *Roswell, N. M.*
University of Oregon.

Geary, R. E. ..... *Portland, Ore.*
University of Oregon.
Graham, T. B. ..... *Nashville, Tenn.*
Vanderbilt University.
Griffith, J. R. ..... *Denver, Colo.*
University of Denver.
Hall, S. D. ..... *Denver, Colo.*
Hallett, A. F. ..... *Denver, Colo.*
Hammond, W. L. ..... *Saguache, Colo.*
Hansen, C. L. ..... *Placentia, Cal.*
Harwood, T. F. ..... *Bloomington, Ill.*
Hooper, R. W. ..... *New York City, N. Y.*
Yale University.
Hurlburt, C. M. ..... *Portland, Ore.*
University of California.
Kelso, D. C. ..... *Edgewater, Colo.*
Krowell, A. W. ..... *Chicago, Ill.*
Kruger, H. A. ..... *Denver, Colo.*
Ledbetter, R. A. ..... *Elizabethtown, Ill.*
Washington University.
Lesh. H. B. ..... *Oak Park, Ill.*
Linderfelt, R. J. ..... *Golden, Colo.*
McClelland, J. V. ..... *Denver, Colo.*
Colorado College.
Mathez, Forrest ..... *Denver, Colo.*
Merrill, Monroe ..... *Hollywood, Cal.*
University of Southern California.
Miller, DeMont G. ..... *Los Angeles, Cal.*
University of Southern California.
Neer, Paul ..... *Golden, Colo.*
Nordenholt, G. D., Jr. ..... *Oak Park. Ill.*
University of Wisconsin.
Norris, D. R. ..... *Denver, Colo.*
Patrick, W. B. ..... *Denver, Colo.*
Princeton University.
Phelps, H. D. ..... *Denver, Colo.*
University of Wisconsin.
Peirce, C. D. ..... *Denver, Colo.*
Rambo, W. C. ..... *Morristown, Pa.*
Ristedt, E. J. ..... *Idaho Springs, Colo.*
Roehrig, G. F., Jr., ... *Denver, Colo.*
Ronan, C. L. ..... *Albany, N. Y.*
Rensselaer Polytechnic Institute.
Rowe, H. L. ..... *Elgin, Ill.*
University of Illinois.
Rush, J. M. ..... *New Carlisle, Ind.*
Purdue University.
Russell, D. O. ..... *London, Eng.*
Sacket, B. L. ..... *Newark, N. J.*
Schafer, Louis ..... *Lake City, Colo.*

Schaffer, B. L. ..... *Del Norte, Colo.*
University of Colorado.
Silver, L. ..... *Aspen, Colo.*
Smart, F. B. ..... *Santa Barbara, Cal.*
Soupcoff, S. M. ..... *Pittsburg, Pa.*
Allegheny College.
Strohl, G. F. ..... *Greeley, Colo.*
Swezey, R. B. ..... *Hinsdale, Ill.*
University of Illinois.
Taggart. O. R. ..... *Denver, Colo.*
Tennant, M. R. ..... *Fergus Falls, Minn.*
University of Denver.
Wasley, W. A. ..... *Greeley, Colo.*
Watson, G. P. ..... *Greeley, Colo.*
Weir, J. A. ..... *Denver, Colo.*
Weizz, J. J. ..... *Chicago, Ill.*
Whipple, V. H. ..... *Chicago, Ill.*
Armour Institute of Technology.
Weinhober, W. H. ..... *Chicago, Ill.*
Cornell University.
Wilett, R. R. ..... *Golden, Colo.*
Wilson, D. M. ..... *Golden, Colo.*

CLASS OF 1910.

FRESHMEN.

OFFICERS.

President, THOS. M. SKINNER, JR.
Vice President, S. R. BROWN, JR.
Secretary, M. H. SHOWMAN.
Treasurer, A. K. ROSE.

Adams, J. C. ..... *Steamboat Springs, Colo.*
Annell, Eric G. ..... *Dundee, Ill.*
Ashley, C. S., Jr. ..... *Boston, Mass.*
Avery. H. C. ..... *Syracuse, N. Y.*
Baker, H. W. ..... *Seattle, Wash.*
Barbour, A. R. ..... *Edgewater, Colo.*
Barnett, W. E. W. ..... *Denver, Colo.*
Barry, V. T. ..... *Golden, Colo.*
University of Kansas.
Blight, W. T. ..... *Golden, Colo.*
Brann, E. R. ..... *Warren, Pa.*
Brown, S. R., Jr. ..... *Montrose, Colo.*
Brown, W. R. ..... *Chicago, Ill.*
Bruderlin, E. J. ..... *Denver, Colo.*
Calvert, C. E. ..... *Whitewater, Wis.*
Campbell, K. P. ..... *Boulder, Colo.*
Carman, J. B. ..... *Denver, Colo.*
Carpenter, P. H. ..... *Sharon, Pa.*
Pennsylvania State College.
Cary, W. P. ..... *Salida, Colo.*
Charles, A. J. ..... *Denver, Colo.*
Christie, L. J. ..... *Quincy, Ill.*
Clarke, M. W. ..... *Mayer, Ariz.*
Clausen, S. J., Jr. ..... *Clear Lake, Ia.*
Coughlan, E. P. ..... *North Dartmouth, Mass.*
Crawford, R. O. ..... *Philadelphia, Pa.*
Currens, W. W. ..... *Denver, Colo.*
Decker, H. P. ..... *Niles, O.*
DeWolf, Clark F. ..... *Findlay, O.*
Dorland, H. E. ..... *Chicago, Ill.*
Dunn, Wm. ..... *Dorchester, Mass.*

Farrar, Russell J. ..... *Salem, Ore.*
University of Oregon.
Findley, Thos. J. ..... *Mattoon, Ill.*
Finley, R. B. ..... *Craig, Colo.*
Fritch, F. G. O. ..... *Colorado Springs, Colo.*
Gehman, Lester ..... *Golden, Colo.*
George, S. L. ..... *Bellevue, Idaho*
Gerinjger, G. T. ..... *Cincinnati, O.*
St. Xavier College.
Gilbert, J. I. ..... *Edgewater, Colo.*
Glasgow, C. M. ..... *St. Louis, Mo.*
Goldberg, L. B. ..... *Kansas City, Mo.*
Graves, T. A. ..... *Olean, N. Y.*
Gregory, A. E. ..... *Coversham, Eng.*
Hamill, W. A. ..... *Woodstown, N. J.*
Hamilton, W. J. ..... *Goleta, Cal.*
University of Southern California.
Hartman, W. J. ..... *Pueblo, Colo.*
Harvey, J. V. ..... *Sioux City, Ia.*
Hastings, J. L. ..... *Denver, Colo.*
Hayden, H. P. ..... *Beaumont, Tex.*
Hennig, J. R. ..... *Casey, Ill.*
Hilton, H. J. ..... *Denver, Colo.*
Hotchkiss, C. B. ..... *Denver, Colo.*
Howe, C. W. ..... *Golden, Colo.*
Howe, F. B. ..... *Colorado Springs, Colo.*
Hoyt, M. R. ..... *Golden, Colo.*
Jackson, R. B. ..... *Denver, Colo.*
Jacobs, H. J. ..... *Denver, Colo.*
Johnson, H. G. ..... *Chicago. Ill.*
Jones, E. F. ..... *Las Esperanzas, Coahuila, Mexico*
Jones, H. H. ..... *Temple, Tex.*
Jones, V. K. ..... *Denver, Colo.*
Juchem, H. H. ..... *Arvada, Colo.*
Keith, L. P. ..... *Golden, Colo.*
Kendall, J. D. ..... *Washington. D. C.*
Kling, D. W. ..... *Marion, O.*
Kopke, N. E. ..... *Beaumont, Tex.*
Labram, F. W. ..... *Chicago, Ill.*
Laughlin, S. W. ..... *Golden, Colo.*
Lee, Frank W., Jr., ... *Denver, Colo.*
Lee, George M. ..... *Boise, Idaho.*
LeMarr, J. R. ..... *Rock Springs, Wyo.*
Linderfelt, T. C. ..... *Golden, Colo.*
McCallum, Jean ..... *Ft. Collins, Colo.*
McKay, G. S. ..... *Townsend, Mont*
Major, F. A. ..... *Creede, Colo.*
Matheson, K. H. ..... *Denver, Colo.*

Mattice, Eugene ..... *Pueblo, Colo.*
May, A. L. ..... *Beaver Falls, Pa.*
Geneva College.
Mullan, H. D. ..... *Sioux City, Ia.*
Iowa State College.
Neece, O. J. ..... *Macomb, Ill.*
Neef, Louis ..... *Denver, Colo.*
Neer, Lee ..... *Golden, Colo.*
Nelson, J. W. ..... *Denver, Colo.*
Oram. C. F. ..... *Golden, Colo.*
Osgood, S. W. ..... *Denver, Colo.*
Owens, J. A. ..... *Salt Lake, Utah.*
Patterson, A. L. ..... *Pueblo, Colo.*
Perry, C. L. ..... *Belleville, Kas.*
Peterson, George ..... *Brush, Colo.*
Pilger, T. F. ..... *Loup City, Neb.*
Pinger, P. J. ..... *Golden, Colo.*
Pullen, L. L. ..... *Golden, Colo.*
Michigan College of Mines.
Purdy, I. A. ..... *Golden, Colo.*
Alma College.
Raedel, L. W. ..... *Denver, Colo.*
Ralston, E. L. ..... *Dewey, Mont.*
Reasoner, R. B. ..... *Colorado Springs, Colo.*
Reed, Sydney ..... *Denver, Colo.*
Rittenhouse, George, Jr. ..... *Plainfield, N. J.*
Roberts. H. M. ..... *Denver, Colo.*
Rose, A. K. ..... *Arvada, Colo.*
Rupert, A. M. ..... *Geneva, N. Y.*
Salisbury, G. W. ..... *Whitewater, Wis.*
Saxton, F. B. ..... *Pueblo, Colo.*
Shapiro, Louis ..... *Colorado Springs, Colo.*
Showman, H. M. ..... *Denver, Colo.*
Skavlen, H. G. ..... *Janesville, Wis.*
Skinner, Thos. M., Jr. ..... *Denver, Colo.*
Spring, Archer ..... *Salem, Mass.*
Stovell, John ..... *Colorado Springs, Colo.*
Swainson, O. W. ..... *Denver, Colo.*
Thorpe, Herbert ..... *Montclair, Colo.*
Turpie, Frank ..... *North Platte, Neb.*
Tweeddale. T. W. ..... *Rugby, Colo.*
Waters, T. E. G. ..... *Denver, Colo.*
Wells, Lucius S. ..... *Grand Junction, Colo.*
West, J. R. ..... *Greeley, Colo.*
Whitehurst, J. W. ..... *Sailda, Colo.*
Wiliams, Thos. T. ..... *Trinidad, Colo.*
University of Illinois.
Wood, S. G. J. ..... *Pittsfield, Mass.*
Woodburn, O. ..... *Denver, Colo.*
Missouri School of Mines.

SUMMARY.

Seniors	36
Juniors	66
Sophomores	74
Freshmen	118
Total	294

THE ALUMNI.

Abel. Walter D., '06 ..... *Landore, Idaho*
Ladd Metals Co.

Adami, Charles J., '99 ..... *Cable Mont.*
Superintendent, Cable Mine

Adams, Charles, '04 ..... *Yerington, Nevada*
Superintendent, Spoagy Mine.

Adams, Wilber E., '00 ..... *Lewiston, Idaho*
Mining Engineer and U. S. Deputy Mineral Surveyor.

Aldrich, Harold W., '06 ..... *Boulder, Colo.*

Allen. Carl A., '05 ..... *Baco y Hijos Choix, Sinaloa, Mex.*
Assistant to Mining Expert.

Allen, Maynard C., '06 ..... *Butte, Mont.*
Mining Engineer, Boston and Montana C. & S. Mining Co.

Aller, Frank B., '92 ..... *Antofagasta, Chili, South America.*
Agent A. S. & R. Co .

Ambrosius, Carl E., '88 ..... *Guanacevi, Durango, Mexico*

Anderson, Axel E., '04 ..... *Chicago, Ill.*
With R. W. Hunt & Co.

Anderson, Neil A., '02 ..... *Frisco, Cactus, Co., Utah*
Surveyor.

Arthur, Edward P., '95 ..... *Cripple Creek, Colorado*
U. S. Deputy Mineral Surveyor.

Atkins, Horace H., Jr., '94 ..... *Mayer, Arizona*
Chemist, Rigby M. & R. Co.

Atkinson, Walter J., '96 ..... *Chicago, Illinois*
Civil Engineer.

Atwater, Maxwell W., '01 ..... *Helena, Montana*
Gold Block.

Austin, Arthur, '05 ..... *706 Locust Streeth Anaconda, Mont.*
Washoe Smelter, Anaconda Copper Mining Co.

Badger, Herbert E., '02 ..... *819 17th St., Greeley, Colo.*
Civil, Hydraulic and Mining Engineer.

Badgley, Charles W., '06 ..... *1730 Franklin St., Denver, Colo.*
Assistant Chemist, A. S. & R. Co.

Bailey, E. W., '05 ..... *Millers, Nev.*
Tonopah Mining Co.

Ball, Max W., '06 ..... *Rawlins, Wyo.*
U. S. Geological Survey.

Barbour, Percy P., '98 ..... *Idaho Springs, Colo.*
Stevens-Barbour & Co., Engineers.

Barensheer, William J., '96..... *Los Angeles, Cal.*
Mining Engineer.

Barker, Franklin L., '06 ..... *Leadville, Colo.*
Western Mining Co.

Barnes, Corrin, '96 ..... *1843 Lawrence St., Denver, Colo.*
Assayer.

Barron, Chauncey F., '02 ..... *El Paso, Texas*

Bartholomew, Tracy, "06 ..... *Flat River, Mo.*
Federal Lead Co.

Beeler, Henry C., '96..... *State Capitol, Cheyenne, Wyo.*
State Geologist.

Bell, Charles Norman, '06 ....*946 Equitable Building, Denver, Colo.*
Champion-Trio M. & M. Co.

Bellam, Henry L., '89 ..... *Saint Clair, Nev.*
Assistant Engineer, U. S. Reclamation Service.

Benwell, George A., Jr., '00 .....*1337 Josephine St., Denver, Colo.*
Mining Engineer.

Bergh, John E., '02 ..... *Bingham Canyon, Utah*
Engineer Bingham Con. M. & S. Co.

Berry, Albert, '05 .....*339 Riverside Ave., Spokane, Wash.*

Bertschy, Perry H., '98 .....*Deadwood. South Dak.*

Bishop, Raymond, '01 .....
Deceased.

Blumenthal, Emil E., '98 .....*Phillipsburg, Mont.*
Chemist and Assayer.

Bowie, James W., '94 ..... *Golden, Colo.*

Bowman, Frank C., '01 .....*Smuggler, Colo.*
Superintendent, Japan-Flora Mines & Tunnel Co.

Bradley, Joseph M., '01 ..... *La Plata, Colo.*
Empire G. M. Co.

Breed, Charles F., '01 ..... *Denver, Colo.*

Brinker, Arthur C., '01 ..... *Ouray, Colo.*
Metallurgist, Camp Bird Mine, Ltd.

Brown, John B., '06 ..*Cerro Prieto, via Magdalena. Sonora, Mexico*
Black Mountain Mining Co.

Brown, Norton H., '92..... *Idaho Springs, Colo.*
U. S. Deputy Mineral Surveyor.

Brown, R. L., '05 ....*1645 Colorado Ave., Colorado Springs, Colo.*
Golden Cycle Mill.

Bruce, Harry F., '00.....*Tonopah, Nev.*
Electro-Geodetic Mining Co.

Bruce, James L., '01 .....*Flat River, Mo.*
Chief Engineer, Federal Lead Co.

Bruce, Stuart S., '99 ..... *Denver, Colo.*
Assistant Engineer, Colorado Department A. S. & R. Co.

Brunel, Rene L, '06 ..... *Butte, Mont.*
Gagnon Mine.

Buck, Arthur H., '97 .....

Bucher, John William, '09 .....*1727 Champa St., Denver, Colo.*

Budrow, William B., '92 .....*Aguas Calientes, Mexico*
Metallurgist, A. S. & R. Co.

Bumsted, Edward J., '01 .....*Valardena, Durango, Mexico*

Burlingame, Walter E., '01.....*1736 Lawrence St.. Denver, Colo.*
Chemist and Assayer.

Busey, A. P., Jr., '05 ..... *Box E, Creede, Colo.*
East Willow Mining Co.

Bussey, Edwin E., '87 ..... *137 Florissant St., Cripple Creek, Colo.*

Butler, G. Montague, '02 ..... *Golden, Colo.*
Instructor in Geology and Mineralogy, Colorado School of Mines.

Canning. Herbert A., '97 ..... *Flat River, Mo.*
Assistant Superintendent, Federal Lead Co.

Carney, Hugh J., '04 ..... *Flat River, Mo.*
Foreman, Diamond Drill Department, Federal Lead Co.

Carstarphen, F. C., '05 ..... *221 McPhee Building, Denver, Colo.*
Hewitt & Carstarphen, Mining and Constructing Engineers.

Chamberlin, W. O., '05 ..... *El Oro, State of Mexico, Mexico*
Esperanza Mining Co.

Chandler, John W., '01 ..... *Coulterville, Mariposa Co., Cal.*
Superintendent, Champion Mine.

Chapman, Thomas L., '06 ..... *Goldfield, Nev.*
Assistant Engineer, Marshall-Ellis Investment Co.

Charles, Lavern J., '02 ..... *Box 834, North Yakina, Wash.*
Assistant Engineer, U. S. Reclamation Service.

Christensen, Walter, '02 ..... *Kimberly, Utah*
Superintendent, Series Con. G. M. M. & C. Co.

Church. Myron J., '98 ..... *935 30th St., Milwaukee, Wis.*
Davis Manufacturing Co.

Clark, George B., '01 ..... *Pueblo, Colo.*
Assayer, Eilers Plant, A. S. & R. Co.

Clark, Winfred N., '98 ..... *Victor, Colo.*
Superintendent, Pueblo and Suburban Traction and Lighting Co.

Coghill, Will H.. '03 ..... *Joplin, Mo.*
Mining Engineer, United Zinc Companies.

Cohen, Louis, '97 ..... *417 Jackson Building, Denver, Colo.*
Mining and Metallurgical Engineer.

Cole, Burt, '92 ..... *Tecumseh. Ala.*
Superintendent, Tecumseh Iron Co.

Coleman, Prewitt R., '03 ..... *Denver, Colo.*

Collbran, Arthur H., '02 ..... *Seoul, Korea*
Superintendent, Suan Mines, Korean Syndicate, Ltd.

Collins, Philip M., '93 ..... *Canon City, Colo.*
U. S. S. Co.

Collins, Shrive B., '01 ..... *Amethyst Postoffice, Creede. Colo.*
Mining Engineer.

Comstock, Charles W., '90 ..... *213 Boston Building, Denver, Colo.*
Civil and Mining Engineer.

Cory, J. J., '05 ..... *Ellamar, Alaska*
Mining Engineer, Ellamar Mining Co.

Corry, Arthur V., '98 ..... *23 Silver Bow Block, Butte, Mont.*
Mining Engineer.

Cox. Augustus D., '93 ..... *Box 144, Palmetto, Nev.*

Cox, W. Ray, '02 ..... *Box 717, Goldfield, Nev.*
Mining Engineer.

Craigue, William H., '89 ..... *Gilmour, Idaho*
Gilmour Mining Co.

Cramer, Curtis P., '99 ..... *Fierro, New Mexico*
Mining Engineer, C. F. & I. Co.

Crowe, Thomas B., '00 ..... *Colorado Springs, Colo.*
Portland Mill.

Crow, Wade L.. '01 .....
Deceased.

Cuno, A. F., '05 ..... *Garfield, Utah*
Assayer, Garfield Smelter.

D'Arcy, R. L., '05 ..... *250 So. 15th St., Denver, Colo.*

Davey, William R., '98 ..... *Lake City, Colo.*

Davis, Carl R., '95 ..... *Rossland, British Columbia*
Superintendent, War Eagle and Center Star Mining Co.

Davis, Gilbert L., '99 ..... *816 Majestic Building, Denver, Colo.*
Assistant Engineer, Denver City Tramway Co.

DeCou, Ralph E., '01 ..... *Mammoth, Ariz.*
Mining.

De Sollar, Tenney C., '04 ..... *Baker City, Ore.*
Mining Engineer and Assayer, United Elkhorn Mining Co.

Devinney, George V., '03 ..... *Denver, Colo.*
Construction Department, Colorado Telephone Co.

Dockery, L. A., '95 ..... *Chihuahua, Mexico*

Dollison, James E., '998 ..... *Alma. Colo.*
Surveyor and Proprietor of the Alma Assay Office.

Dow, William G., '06 ..... *Scottsbluff, Neb.*
U. S. Reclamation Service.

Downer, Roger H., '01 ..... *Box 175, Goldfield, Nev.*
Downer Brothers, Assayers and Chemists.

Draper, Marshall D., '97 ..... *215 McPhee Building, Denver, Colo.*
Mining Engineer, American Exploitation Co.

Drescher, Frank M.. '00..... *Prescott, Ariz.*
Mining Engineer.

Duer, C. L., '05 ..... *Box 95, Boulder, Colo.*
With Wilson and Fair, Civil and Mining Engineers.

Durell, Charles F., '95 ..... *Gilt Edge, Mont.*
Manager, Central Montana Mines Co.

Dunkle, Fred W., '09 ..... *Millett, (via Austin), Nev.*

Dwelle. Jesse E., '96 ..... *2244 Gaylord St., Denver. Colo.*
Mining Engineer, Venture Corporation. Ltd.

Eames, L. B., '05 ..... *Terry, South Dak.*

Eaton, Albert L., '95 ..... *Chihuahua, Mexico*
Assistant Superintendent, Chihuahua Mining Co.

Ehle, Mark, Jr., '01 ..... *Rapid City, South Dak.*
Professor of Mining, South Dakota School of Mines.

Ehrich, Walter L., '02 .....

Ellis, William W., '02 ..*300 Railway Exchange Bldg.. Denver, Colo.*
Manager, Continental Exploration Co.

Emeis. Walter A., '04 ..... *Shullsburg, Wis.*
Secretary and Superintendent, Iowa Mining Co.

Emrich, Horace H., '03 ..... *142 Water St., Perth Amboy, N. J.*
Assistant to Superintendent, A. S. & R. Co.

Estes, Frank M., '02 ..... *El Oro, State of Mexico, Mexico*
Esperanza Mining Co.

Evans, Henry R., '00 ..... *Armington, Mont.*
G. N. Railway.

Ewing. Charles R., '00 ..... *Del Norte, Colo.*

Eye, Clyde M., '95 ..... *512 Schneidel Bldg., San Francisco, Cal.*
Febles, John C., '97 ..... *Box 105, Butte, Mont.*
Chemist, Anaconda Copper Co.
Field, Fred M., '95 ..... *Beatty, Nev.*
Metallurgist, Consolidated Montgomery Shoshone Mines Co.
Fillius, Lee L., '04 ..... *Telluride, Colo.*
Cyanide Department, Smuggler Union Mining Co.
Finigan, William Henry, '06 ..... *Victor, Colo.*
Assistant Engineer, Portland G. M. Co.
Fleming, William L., '03 .....
Flint, F. F., '05 ..... *R. F. D. No. 4, Greeley, Colo.*
Floyd, John A., '88 .....
Deceased.
Ford, Homer D., '05 ..... *Palmer, Mo.*
Guggenheim Exploration Co.
Foster, George C., '03 ..... *1734 Arapahoe St., Denver, Colo.*
Care Henry E. Wood & Co.
Franck, Albert C., '04 ..... *Ouray. Colo.*
Resident Engineer, Barstow M. and M. Co.
Franck, Robert P., '04 ..... *Nacozari, Sonora, Mexico*
Moctezuma Copper Co.
Frank, Harry L., '01 ..... *Dedrick, Trinity Co., Cal.*
G. M. Co.
Frank, Morton E., '06 .....
Freeland, William H.. Jr., '06 ..... *Hailey, Idaho*
Fry, Louis D., '03 ..... *Silver Plume, Colo.*
Mining.
Funk, Walter A., '03 ..... *Central City, Colo.*
Mining Engineer and U. S. Deputy Mineral Surveyor.
Gardner, John Ira, '06 ..... *Silver Plume, Colo.*
Dives-Pelican Mining Co.
Garza Adalpe, J. M., '06 ..... *San Gabriel, Durango, Mexico*
Evanston Mining Co.
Gehrmann, Charles A., '86..... *1420 Franklin St., Denver, Colo.*
Mining Engineer.
Giddings, Donald S., '00 .. *1414 Colorado Ave., Colorado Sp'gs, Colo.*
Gilbert, Arthur K., '06 ..... *Walsenburg, Colo.*
Assistant Engineer, C. F. and I. Co.
Gilbert, William J., '06 ..... *Masonic, Cal.*
Goodale, Stephen L., '04 ..... *Lander, Cal.*
Gordon, John G., Jr., '06 ..... *Hibbing, Minn.*
Engineering Department, U. S. Steel Co., Mesabi Range.
Grant, Lester S., '99 ..... *Independence. Colo.*
Findley Con. M. Co.
Gray, Latimer D., '95 ..... *Rock Springs, Wyo.*
Manager, Electrical Department, U. P. Coal Co.
Greve, E. E., '05 ..... *492 First Ave., Brooklyn, N. Y.*
Grider, R. L., '05 ..... *Seiad Valley, Siskiyou Co., Cal.*
Mining.
Griswold, George G., '96 ..... *Salida, Colo.*
Superintendent, Ohio and Colorado Smelter.
Gross, John, '97 ..... *417 Jackson Building, Denver, Colo*
Mining and Metallurgical Engineer.

Hallett, R. L., '05 ..... *Selby, Contra Costa Co., Cal.*
Chemist, A. S. and R. Co.

Hallett, W. J., '05 ..... *Lake City, Colo.*
Carson Mining and Reduction Co.

Hamilton, Frank R., '98 ..... *Denver, Colo.*
Denver Gas and Electric Co.

Harkison, Charles W., '06 ..... *Terry, South Dak.*
Wilson Mill.

Harrington, Daniel, '00 ..... *Sunnyside, Utah*
Chief Engineer, Utah Fuel Co.

Harrington, Orville. '98 ..... *1485 So. University St., Denver, Colo.*
U. S. Mint.

Harris, Willard F., '01 .....

Hartzell, Lester J., '95 ..... *Butte, Mont.*
Instructor in Laboratories, Montana School of Mines.

Hawley, Howard R., '93 ..... *Canon City, Colo.*
U. S. S. Co.

Hazard, William J, '97 ..... *Golden, Colo.*
Assistant Professor of Electrical Engineering, Colorado School of Mines.

Heitz, George H., '06 ..... *Box 526, Leadville, Colo.*
Surveyor.

Hensley, James H., '06 ..... *Hadley, Ketchikan P. O., Alaska*

Hewitt, A. F., '05 ..... *221 McPhee Building, Denver, Colo.*
Hewitt-Carstarphen Co., Mining and Construction Engineers.

Hill, Frank C., '0 ..... *Winter Quarters, Utah*
Utah Fuel Co.

Hindry, Willis E., '92 ..... *El Oro, Mexico*
General Manager, Esperanza Mining Co.

Hodgson, Arthur, '99 ..... *Denver, Colo.*
Assayer, Denver Mint.

Hornbein, Julius, '05 ..... *Christmas, Arizona*
Chemist, Saddle Mountain Mining Co.

Hoyt, George F., '96 ..... *Golden, Colo.*

Hunt, T. R., '05 ..... *Poland, Arizona*

Hyder, C. A., '05 ..... *Moctezuma, Sonora, Mexico*
Mining Engineer.

Hyder, Frederick B., '03 ..... *Moctezuma, Sonora, Mexico*
Mining Engineer.

Ickis, Harry M., '02 ..... *Manila, P. I.*
Field Assistant, Bureau of Mines.

Ingersoll, Julius C., Jr., '06 ..... *Ironton, Colo.*
Chemist, Continental Smelting and Refining Co.

Ingols, J. August, '98 ..... *Milford, Beaver Co., Utah*
General Superintendent, Majestic Copper M. and S. Co.

Izett, Glenn, '03 ..... *Box 22, Littleton, Colo.*
Surveying and Construction Work, Denver Union Water Co.

Jackson, Walter H., '01 ..... *Mapimi, Durango, Mexico*
Mining Engineer, Compania Minera de Penoles.

Jarvis, Royal P., '97 ..... *Pullman, Wash.*
Professor of Mining Engineering and Metallurgy, Washington Agricultural College.

Jewel, Gilbert E., '93 ..... *Queensland, Australia*
Chartres Towers.

Johnson, Edward W., '91 ..... *Salt Lake, Utah*
Garfield Smelting Co.

Johnson, Gilbert, Jr., '99 .....
Deceased.

Johnson, Junius W., '01 .....
Deceased.

Johnson, Lafayette G., '04 ..... *Flat River, Mo.*
Engineer, Federal Lead Co.

Johnston, Fred, '98 ..... *Leadville, Colo.*
Assistant Superintendent, Arkansas Valley Plant, A. S. and R. Co.

Jones, Edward B., '00 ..... *316 Dooly Block, Salt Lake City, Utah*
Consulting Mining Engineer and Metallurgist.

Jones, Fred, '00 ..... *Colorado Springs, Colo.*
Mining Engineer, with J. R. Finlay.

Jones, Mrs. F. H., '98 ..... *Ely, Nev.*

Jones, Frank H., '98 ..... *Ely, Nev.*
Assistant Engineer, Nevada Consolidated Copper Co.

Kell, Wayne S., '06 ..... *Dahlonega, Ga.*
Professor of Mining and Electrical Engineering, North Georgia Agr. College.

Kelly, Fred G., '99 .....

Kelly, William A., '97 ..... *311 E. Eaton Ave., Cripple Creek, Colo.*
Cyanide Milling.

Kennedy, George A., '95 .... *719 E. and C. Building, Denver, Colo.*
Mining Engineer, Venture Company of London.

Kilbourne, William D., '04 ..... *Pueblo, Colo.*
C. F. and I. Co.

Kimball, George K., Jr.. '92 ..... *Idaho Springs, Colo.*
General Manager, Old Town Mining Co.

Kimball, Joseph S., '92 ..... *Russell Gulch, Colo.*
Mining.

Kimball, Harlow M., '04 ..... *Great Falls, Mont.*
Boston and Montana Con. Copper and Silver Mining Co.

King, Henry E., '03 ..... *419 E. Kiowa St., Colorado Springs, Colo.*
Assistant City Engineer.

Kingman, Jerry, '88 .....
Deceased.

Kleff, J. Marvin, '06 ..... *119 E. 8th St., Leadville, Colo.*
Yak M., M. and T. Co.

Koerner, Albert J., '06 ..... *3043 Gray St., Denver, Colo.*

Kraemer, Edwin L., '98 ..... *Shem City, Utah*
Utah and Eastern Copper Co.

Lampe, Oscar A., '98 ..... *Guanajuato, Apartado No. 55, Mexico*
Superintendent, Cyanide Plant, G. R. and M. Co.

Larison, E. L., '05, ... *Isabella, Tenn.*
Chemist.

Larsh, Walter S., '04 ..... *Ely, Nev.*
Assistant Superintendent, Cumberland Ely Copper Co.

Lee, Robert P., '05 ..... *Moctezuma, Sonora, Mexico*
Surveyor and Assayer, Sonora M. Agency.

Lee, Wallace, '04, ... *Ures, Sonora, Mexico*
Mining Engineer, care Wendler and Lee.

Lehmer, Frank W., '02 .....

Lemke, Carl, '00 .....

Lennox, L. W., '05 ..... *Victor, Colo.*
Strong G. M. Co.

Lerchen, F. H., '97 .....*Box 175, Deming, N. M.*
Luna Lead Co.

Levy, Archibald L., '06 .....*3238 Vernon Ave., Chicago, Ill.*
Superintendent, International Mining Co.

Lewis, Frank E., '01 .....*Orogrande, N. M.*
Assayer, care S. W. and R. Co.

Lewis, William B., '92 .....*206 Coronado Building, Denver, Colo.*

Lewis, Frank E., '01 ..... *Oro Grande, N. M.*
General Manager, South Canon Coal Co.

Libby, James L., '06 ..... *Rock Springs, Wyo.*
Assistant Engineer, Union Pacific Coal Co.

Liddell, Charles A., '03 .....*Manhattan, Nye Co., Nev.*
Surveyor and Mining Engineer.

Liddell, T. Parker, '03 ..... *Tuscarora, Nev.*
Surveyor and Mining Engineer.

Limback, Edmund C., '95 ....*Mason P. O., Broadwater Co., Mont.*
Park-New Era Mines.

Logue, N. W., '97 .....*El Tigre, Sonora, Mexico*
Mining Engineer.

Lonergan, P. Jay, Jr., '05 .....*Greenwater, Inyo County, Cal.*
U. S. Deputy Mineral Surveyor.

Lorah, Bela I., '88 .....
Deceased.

Lovering, Ira G., '01 .....*1107 N. Stanton St., El Paso, Texas*

Lucy, Frank Allen, '01 .....*Goldfield, Nev.*
Mining Engineer.

Lucy, Richarw W., '98 ..... *Central City, Colo.*

McCart, Robert, '95 .....*Silverton, Colo.*
Engineer, Silver Lake Mines.

McDaniel, A. K., '95 .....*111 W. 4th Ave., Denver, Colo.*
Mining Engineer.

McDermutt, Grace C. U., '03 ..... *Washington, D. C.*
Bureau of Standards.

McElvenny, Robert F., '03 .....*1420 N. Steele St., Tacoma, Wash.*
Superintendent, Lead Works, American Smelters Supply Co.

MacGregor, George H., '97 ..... *Central City, Colo.*
Mine Superintendent, New Foundland Mine.

McLeod, J. Norman, '97 .....*1734 Glenarm St., Denver, Colo.*
Assayer and Chemist.

McMahon, Charles H., '92..*Asientos, State of Aguas Calientes, Mex.*
Mine Superintendent, A. S. and R. Co.

Magenau, William '98 .....*Box 232, Deming, N. M.*
Smelter Superintendent.

Malmstrom, C. Clarence, '00 .....*1109 E. 13th Ave., Denver, Colo.*
Assayer, Denver Mint.

Marrs, George O., '01 .....*Denver, Colo.*
Montgomery Machinery Co.

May, John G., '01 .....*Oxford Hotel, Denver, Colo.*
Mining Engineer.

Maxwell, Fred A. G., '95 *Box 2, Randfontein, Transvaal, S. Africa*
Metallurgist, Randfontein Estates.
Maynard, Rea E., '96 .....
Merryman, Herbert E., '95 .....*Enterprise, Ore.*
U. S. Deputy Mineral Surveyor.
Merwin, Eugene W., '03 ..*Room 17, Court House, Los Angeles, Cal.*
Middelkamp, L. L., '05 .....*106 14th Ave. N., Seattle, Wash.*
Middleton, William B., '83 .....
Millard, Frank W., '01 .....*Ely, Nev.*
Mining Engineer.
Milliken, John F., '96 .....*Colorado Springs, Colo.*
Superintendent, Golden Cycle Mining Co.
Milliken, William B., '93 .....*8th and Larimer Sts., Denver, Colo.*
F. M. Davis Iron Works Co.
Mitchell, George B., '96 .....*New Haven, Conn.*
Superintendent of Buildings, N. Y., N. H. and H. R. R.
Montrose, James F., '02 .....*1549 St. Paul St., Denver, Colo.*
Moss, Cleveland O., '02 .....*El Tiro, via Red Rock, Arizona*
Superintendent, Cleveland Arizona Mining Co.
Moynahan, Ambrose E., '00 .....*Alma, Colo.*
Assayer and Mining Engineer.
Muir, David, '99 ..... *Yaalpom, Cal.*
Muir, Douglas, '05 ..... *Guanajuato, Gto. Mexico*
Mining Engineer.
Nagel, Frank J., '03 .....*2335 Stout St., Denver, Colo.*
Nagel, Henry P., Jr., '04 .....*2335 Stout St., Denver, Colo.*
Nance, William H., '96 .....*Breckenridge, Colo.*
Superintendent of Milling Department, Quandary Mt. M. and M. Co.
Nelson, H. E., '97 ..... *Colorado Springs, Colo.*
Colden Cycle Mining Co.
Neugebauer, Karl E., '06 .....*Mapimi, Durango, Mexico*
Compania Minera de Penoles.
Neville, J. B., Jr., '05 .....*836 Ogden St., Denver, Colo.*
Newman, William E., '96 ..... *Omaha, Neb.*
Chemist, Omaha Plant, American Smelting and Refining Co.
Nicolson, George W., '00 ..... *Box 34, Mojave, Cal.*
Norman, John E., '98 ..*302 Mining Exchange Bldg., Denver, Colo.*
Mining Engineer.
Nyberg, H. Edward, '06 .....*Deadwood, S. Dak.*
Nye, Robert, '97 ..... *Placerville, Idaho*
Moline Mining Co.
O'Byrne, Joseph F., '05 .....*Barlow Mine, Lumpkin Co., Ga.*
Manager, Barlow Mine, Dahlonega Con. Gold Mining Co.
Osborne, Arthur H., '93..... *Georgetown, Colo.*
Mining Engineer and U. S. Mineral Surveyor.
Palsgrove, Harry G., '03 .....*Coahuila, Mexico*
Paredes, Evaristo, Jr., '05 .....*Culiacan, Sinaloa, Mexico*
Assistant Engineer, Sinaloa Land and Water Co.
Parks, George A., '06 .....*3081 W. 26th Ave., Denver, Colo.*
Parker, James H., '95..*Rooms 13-14, Masonic Temple, El Paso, Tex.*
Mining Engineer.

Parrish, Carl C., '01 ..... *Colombia, South America*
Mining Engineer.
Parsons, Horace F., '03 ..... *Salt Lake City, Utah*
Patterson, S. B., Jr., '06 ..... *Robesonia, Pa.*
Robesonia Iron Co.
Paul, Russell B., '02 .... *San Juancito, Honduras, Central America*
Mining Engineer, New York and Honduras Rosario M. Co.
Paul, William H., '96 ..... *206 Equitable Bldg., Denver, Colo.*
Mining Engineer, Empire Zinc Co.
Pendery, John M., '00 ..... *Leadville, Colo.*
Yak Tunnel M. and M. Co.
Pfeiffer, G. N., '05 ..... *925 5th Ave., Durango, Colo.*
Surveyor.
Pilger, Newton W., '06 ..... *Ruby, Mont.*
Assistant Engineer, Conrey Placer Mining Co.
Platt, Edwin H., '00 ..... *Coahuila, Mexico*
Jimulco Mining Co.
Post, George M., '94 ..... *2928 Hale St., Denver, Colo.*
Assistant City Engineer.
Powell, George F., '97 ..... *Idaho Springs, Colo.*
Superintendent, Stanley Mine.
Powers, Oliver, '02 ..... *Oakland, Cal.*
Pray, Winfred A., '01 ..... *Wadsworth, Nev.*
Surveyor.
Pressler, L. P., '05 ..... *Vantrent, Cal.*
Assayer, Dairy Farm Mining Co.
Price, Lyttleton, Jr., '00 ..... *Bellvue, Idaho*
Minnie Moore Mining Co., Ltd.
Prier, Truman Delmar, '04 ..... *Ruby, Mont.*
Engineer, Conrey Placer Mining Co.
Prout, John, '00 ..... *Golden, Colo.*
Putnam, George B., '05 ..... *137 W. 9th St., Leadville, Colo.*
Mining Engineer and Surveyor.
Rabb, E. M., '05 ..... *Box 4, Pilares de Nacozari, Sonora, Mexico*
Moctezuma Copper Co.
Rath, C. M., '05 ..... *Hanna, Wyo.*
Assistant Engineer, U. P. Coal Co.
Reinhard, F. J., '05 ..... *Shoshoni, Wyo.*
Reno, Horace T., '02 ..... *Arvada, Colo.*
Rhodes, William B., '03 ..... *Rosario, Sinaloa, Mexico*
Mines del Tojo, via Tepic.
Richards, E. R., '05 ..... *St. Elmo, Colo.*
Assayer.
Richards, John V., '02 ..... *Stillwater, Nev.*
Ripley, G. Clinton, '06 ..... *Box 5, Tonopah, Nev.*
Hannapah M. and S. Co.
Rising, Arthur F., '99 .....
Deceased.
Robey, Loyd, '00 ..... *San Gabriel, Durango, Mexico*
Mining Engineer, San Louis Mining Co.
Robinson, George P., '04 ..... *Howardsville, Colo.*
Highland Mary Mine, Gold Tunnel Drainage and T. Co.

Rodriguey, J. C., '98 ..... *City of Mexico, Mexico*
Mining Engineer.

Roller, Arthur H., '97 ..... *Idaho Springs, Colo.*
Manager, Shafter Mine Co. and Hudson Reduction Co.

Rowe, Charles E., '02 ..... *Austin, Texas*
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Rowe, Edward E., '95..... *1250 Boulevard F, Denver, Colo.*
Manager E. E. Rowe & Co., Pressed Brick.

Royer, Frank W., '99 ..... *4003 W. 35th Ave., Denver, Colo.*
Mining Engineer.

Rudd, Arthur H., '00 ..... *Enterprise, Ore.*
Mining Engineer.

Ryan. W. E., '05 ..... *Room 5, Union Depot, Pueblo, Colo.*
D. and R. G. R. R.

Saint Dizier, Julius D., '94 ..... *San Luis Potosi, Mexico*

Sale, Andrew J., '00 ..... *Box 386, Cripple Creek, Colo.*

Scheble, Max C., '01 ..... *Sabinas, Coahuila, Mexico*
Superintendent, Gral Compania Carbomfus.

Schlereth, C. Quimby, '06 ..... *Ojuela, Durango, Mexico*
Compania Minera de Penoles.

Schneider, George W., '94 ..... *136 Logan Ave., Denver, Colo.*
State Mine Inspector.

Schumann, Enrique A., '97 .....

Sherman, Scott H., '04 ..... *Jardine, Mont.*
Kimberly-Montana G. M. Co.

Shetler, Waverly, '95 .....
Deceased.

Sill, Rush T., '06 ..... *Hibbing, Minn.*
Geological and Mining Department, Great Northern R. R.

Simpson, William P., '01 .....
..... *Apartado 101, Monterrey, Nuevo Leon, Mexico*
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Skinner, Lewis B., '95 ..... *Denver, Colo.*
Consulting Chemist and Metallurgist, Western Chem. Manufacturing Co.

Sloan, Arthur W., '03 ..... *Silver City, N. M.*
Chemist, Silver City Reduction Works.

Slater, Amos E., '00 ..... *Tacoma, Wash.*
Geologist, Northern Pacific Railway.

Small, Harvey B., '01 ..... *Colombia, South America*
Mining Engineer.

Smith, C. Dupre, '91 ..... *Newton, Iowa*
Consulting Mining and Metallurgical Engineer.

Smith, Claude H., '00 .....
Deceased.

Smith, E. M., '05 ..... *Box 246, Montrose, Colo.*

Smith, Harry C., '98 ..... *1132 Washington Ave., Denver, Colo.*
Mining Engineer.

Smith, Thomas G., '99 ..... *233 So. Emerson St., Denver, Colo.*

Spangler, Howard, '05 ..... *Victor, Colo.*
Assistant Engineer, Portland G. M. Co.

Spencer, Walter I., '04 ..... *868 E. Ash St., Portland, Ore.*
Civil and Contracting Engineer.

Stannard, Burt C., '95 ..... *Everett, Wash.*
Chemist, Puget Sound Reduction Co.

Starbird, H. B., '97 .....*2646 Magnolia Ave., Los Angeles, Cal.*
Mining Engineer.

Starbird, Edwin P., '01 .....*2646 Magnolia Ave., Los Angeles, Cal.*
Mining Engineer.

Steele, James H., '00 .....*1041 Lafayette St., Denver, Colo.*
Instructor in Mathematics and Drafting, M. T. H. S.

Steinhauer, F. C., '99 ..... *Denver, Colo.*
Assistant Engineer, Board of Public Works.

Stephens, Charles N., '98 .....*Box 234, Oshkosh, Wis.*
Surveyor, Survey of Lake Winnebago.

Stephens, Wallace A., '93 .....*1361 Logan Ave., Denver, Colo.*
Mining.

Stephenson, Tiffany E., '06 .....*115 W. Quartz St., Butte, Mont.*
Gagnon Mine.

Stockton, Robert S., '95 .....*Huntley, Mont.*
U. S. Reclamation Service.

Stoeckley, E. F., '06 .....*Greenwater, Inyo Co., Cal.*
U. S. Deputy Mineral Surveyor.

Storm, Lynn W., '02 ..... *Dawson, N. M.*
Mining Engineer. Dawson Fuel Co.

Street, Gerald B., '01 ....*56 W. 4th South St., Salt Lake City, Utah*

Strout, Fred M., '96 .....*Deadwood, So. Dak.*
General Superintendent, Golden Crest Mining Co.

Suhr, Otto B., '95 .....*Provo, Utah*
Engineer, Telluride Power Co.

Taggart, George K., '03 .....*Coapa, Michoacan, Mexico*
Superintendent and Mining Engineer, National Capital Copper M. Co.

Taylor, Harry P., '00..... *Whitehall, Mont.*

Terrill, A. C., '05..... *Eugene, Oro.*
Professor of Mining, University of Oregon.

Tescher, Samuel, '04 .....*17th and Blake Sts., Denver, Colo.*

Thomas, John S., '04 .....
Deceased.

Thomson, A. T., '05 .....*119 W. 17th St., Pueblo, Colo.*
City Engineer's Office.

Thomson, Francis A., '04 .....*Pullman, Wash.*
Professor of Mining and Metallurgy. Washington Agr. College.

Thompson, James S., '99 ..... *Sopris, Colo.*
Superintendent. C. F. and I. Co.

Thum, Ernest E., '06 ..... *Anaconda, Mont.*
Assistant Constructing Engineer, Amalgamated Copper Co.

Titsworth, Frederick S., '95 ....*420 Equitable Bldg., Denver, Colo.*
Lawyer.

Townsend, Arthur R., '99 .....*117 E. 57th St., New York*
Consulting Engineer.

Trott, Roland S., '06 .....*Golden, Colo.*

Trumbull, Loyal W., '04 .....*Laramie, Wyo.*
Professor of Mining Engineering, University of Wyoming.

Tyler, Sydney B., '99 .....*Panuco de Coronado, Durango, Mexico*
Mine and Mill Superintendent, San Luis Mining Co.

Utley, Howard H., '00 .....*415 W. Jefferson St., Louisville, Ky.*
Engineer, North Jelllico Coal Co.

Valentine, Malvern R., '98 .....*Box 108, Victor, Colo.*
Manager, Taylor and Brunton Sampler.

Van Diest, Edmond C., '86 ..... *Box 826, Colorado Springs, Colo.*
Civil Engineer.

Van Wagenen, Hugh R., '06 ..... *Dome, Yuma Co., Arizona*
Superintendent, Castle Dome Mines.

Vaughn, Robert M., '04 .....
Deceased.

Wackenhut, George J., '04 ..... *Globe, Ariz.*
Pinto Creek M. & C. Co.

Waddey, Albert Y., '06 .....*Idaho Springs, Colo.*
President, Old Stag Gold M. and M. Co.

Wallace, Howard J., '04 .....*519 Boston Bldg., Denver, Colo.*
Engineering Department, A. S. and R. Co.

Wallace, Louis R., '95 .....*Morenci, Arizona*

Waltman, Will D., '99 .....*Empire, Canal Zone, Panama*
Supervisor, Mining Department, Culebra Division.

Ward, William F., '03 ..... *Ruby, Mont.*
Engineer Conrey Placer Mining Co.

Warnecke, Carl M., '97 .....*Sherman, Cal.*
Electrical Engineer, Los Angeles and Pacific Ry. Co.

Washburn, Howard G., '04 .....*Flat River, Mo.*

Watson, Hugh C., '01 .....*Mapimi, Durango, Mexico*
Assistant Superintendent, Ojuela Mine, Compania Minera de Penoles.

Wattles, William C., '03 .....*1330 De Long St., Los Angeles, Cal.*
Deputy County Surveyor.

Watts, Alfred C., '02 .....*Box 285, Walsenburg, Colo.*
Assistant Div. Engineer, C. F. and I.

Weed, Floyd, '97 .....*467 Emerson St., Denver, Colo.*

Weil, Jacob, '04 ..... *Leadville, Colo.*
Chemist, Arkansas Valley Plant, A. S. and R. Co.

Weiss, Andrew, '99 .....*Wyncote, Wyo.*
U. S. Reclamation Service.

Wells, Benjamin T., '04 ..... *Anaconda, Mont.*
Testing Department, A. C. M. Co.

Wells, Frank B., '03..*Santa Rosa, District La Union, Salvador, C. A.*
Assayer, Salvador Mines, Ltd.

Wertheim-Salomonson, F. M. G. A., '89 .....
Deceased.

Wheeler, Charles E., 94 .....

Whitaker, Orville R., '98 .....*Mapimi, Durango, Mexico*
General Superintendent, Compania Minera de Penoles.

Wiley, Walter H., '83..*367 So. Bonnie Brae St., Los Angeles, Cal.*
Mining Engineer.

Williams, Fred T., '01 ..... *Victor, Colo.*
Mining Engineer, Portland G. M. Co.

Williams, Wakely A, '99 .....*Grand Forks, British Columbia*
Superintendent, Granby Smelter.

Wolf, Harry J., '03 ..... *Ouray, Colo.*
Chief Engineer, Camp Bird Mine.

Woods, Thomas H., '97 ..... *Box F, Ouray, Colo.*
Superintendent, Camp Bird Mill, Ltd.
Young, Frank B., '95 ..... *Lindsay, Cal.*
Mining Engineer.

The Honorary Degree of the school has been conferred upon the following:

Berthoud, Capt. E. L. ..... *Golden, Colo.*
Blow, A. A. ..... *London, England*
Mining Engineer.
Hale, Gen. Irving ..... *Denver, Colo.*
General Agent, Gen. Electric Co.
Bulkley, Frank ..... *Denver, Colo.*
Mining Engineer.
McDonald, Jesse F. ..... *Denver, Colo.*
Governor of Colorado.

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INDEX.

INDEX.

VOLUME ONE NUMBER THREE

Quarterly

of the

Colorado School of Mines

JANUARY 1907

Issued Quarterly by the Colorado School of Mines
Golden, Colorado

Entered as Second Class Mail Matter, July 10, 1906, at the Postoffice at Golden, Colorado, under the Act of Congress of July 16, 1894

Quarterly
of the
Colorado School of Mines

VOL. I JANUARY, 1907 NO. 3

Dedication of Simon Guggenheim Hall

Simon Guggenheim Hall, erected and equipped at a cost of eighty thousand dollars, and presented to the Colorado School of Mines by Mr. Simon Guggenheim, was dedicated October 17th, 1906, in the presence of a large and distinguished audience.

The program of exercises was as follows:

Coronation March—"Folkunger" ..... Kretschmer
Lohmann's Orchestra

Invocation ..... Rev. S. R. Wood

Selection—"Mlle. Modiste" ..... Herbert
Lohmann's Orchestra

Dedicatory Address ..... Rev. F. W. Gunsaulus, D.D.
President, Armour Institute of Technology, Chicago

Reverie—"The Rose's Honeymoon" ..... Bratton
Lohmann's Orchestra

Unveiling of the portraits, presented by the Alumni, of Dr. Regis Chauvenet, former President of the Colorado School of Mines, and of Mr. Simon Guggenheim, the donor of the building.

Presentation ..... Mr. George M. Post, '94

Acceptance ..... Mr. W. B. Lewis, '92
Member of the Board of Trustees

Selection—"Bohemian Girl" ..... Balfe
Lohmann's Orchestra

Presentation of Keys of Building.....Mr. Simon Guggenheim

Acceptance of Keys ..... Dr. John P. Kelly
President of the Board of Trustees

Selection—"Two Hungarian Dances" ..... Brahms
Lohmann's Orchestra
Address ..... Rabbi W. S. Friedman
Intermezzo—"Marcella" ..... Johnson
Lohmann's Orchestra
Benediction ..... Rev. C. M. Pullen

Dr. F. W. Gunsaulus, President of Armour Institute of Technology, of Chicago, delivered the Dedicatory Address:

"Ladies and Gentlemen: I am most happy to-day to bring to this institution the felicitations and congratulations of Armour Institute of Technology, of the Chicago University, of the Northwestern University, and, indeed, an earnest and sincere prayer for you upon the part of every man in America who loves the alliance of this flag with the highest ideals of education. When a distinguished and successful fellow citizen proposes to add to the instrumentalities of a great commonwealth something that shall embody his gratitude and his hope, and his large mindedness, and his patriotism, so that these instrumentalities shall go down for ages to come, it is fitting that encouragement should be given to such a man, and that we should express the gratitude, not only of the commonwealth, but the whole country, for such a gift as this. The real problem at the Armour Institute of Technology, the problem which confronts all public benefactions, is not your problem, nor my problem, but it is one that surrounds itself with the best husbanding and best use of all the powers in all our commonwealth toward the creation of an ideal union, toward the making of a national education worthy of the name of America, worthy of the history and hope of our common citizenship. When we bade good-bye, a little time ago, to my friend Dr. Alderson, now president of this institution, it was with a clear-sighted understanding of this relationship which must abide more and more strongly and effectually as the ideals of our national success are accomplished.

"The Armour Institute, for example, has no course in mining engineering. It is not for lack of funds; it is not for lack of interest; it is not for lack of opportunity, for the city of Chicago has been so impressed by eloquent gentlemen from Colorado as to vast mineral deposits, which are simply waiting some enthusiast to buy, that almost every man in our city wants to be a miner, and it would be the easiest thing in the world to constitute a so-called school of mining in that great metropolis.

Colorado Best Place for School of Mines.

"We have no school of mining because we know that specialization is not in name only, but that here, in a most marvelous manner, the opportunity is ready for the growth and development of a great university of mining education. No man can help but feel that there is no distance in this land to-day, as educators from all over the country realize that a definite step forward has been taken by the addition of a great private beneficence to public generosity, in the development of the most important mining school to-day in the United States, even in the world. Chicago is richer to-day because Denver is richer. Illinois is richer because Colorado is richer. The East is richer because the West is richer. For the fact is that our great opportunity, prepared by Providence, nurtured by that inspiration, of your great hearted and great mountain commonwealth, is here in Golden.

"Our opportunity has been made, and it has been made with such triumph, that such energetic thoughtfulness, that such ideas placed like banners before the advancing importance of the future, that the whole round world is interested in this point, this great beacon that cannot be lifted more lofty over the whole summit, over the entire earth than in Colorado, and we bring to you here our congratulations and we offer to Almighty God our prayers that this institution may have the nurture and loyalty of your commonwealth. The state of Iowa has not overlooked her opportunity. The greatest agricultural state in the Union has established what is perhaps the greatest agricultural college in the Union, and next spring will go forth men to teach the fruits of their learning, and add untold wealth to the state which has exercised such forethought. So has Colorado taken a great stride forward in the advancement of its greatest industry, in the establishing of this great school of mines.

"Here you have Japanese students and British students. From these hills will come, and from all over this country will come, men who wish to make special preparation for a mining career. I have come here to tell you that twenty years from to-day, my friends, you will recognize these facts by the wonderful results, the creation of a vast laboratory which constitutes the whole state, by the glorious atmosphere that radiates culture, by the inspiration of the air, which almost makes me believe in the vast opportunities of the intelligent, higher life. Your Colorado has a pedestal loftier than that of any other state

in the Union. Here this pedestal lifts itself in light. You must place upon that pedestal a statue equal to the pedestal itself. Place there the richest, the most noble, the most ideal and wonderfully perfect mining school in the world.

Private Beneficence and Public Generosity.

"It is an interesting fact also that we come at a moment in which private beneficence and public generosity have joined hands in the larger work of education. It is absurd to tell us that the factor of individuality can be dispensed with, for in all socialistic movements, you cannot take out of education or reform, or upward movement, the beating of the human heart. We cannot afford to rob Massachusetts of her John Harvard, nor New York of her Ezra Cornell, for we must have the warm personal inspiration as well as any other quality. This personality comes to us in an atmosphere, pervasive and all surrounding, and proposes on the stem of the state to graft its own personal interest, its inspiration, its gratitude, its responsibility, and its patriotism, so that the juices of the state, rising up through the stem, at last express themselves in the blossom, which is indeed the noble heart and intellect of a private citizen. It is this culture and associated personal power that makes the man. Who does not feel a touch upon his heart, a responsive chord, when he beholds a name written like this name upon the lintel of the door of a great monument like this, Simon Guggenheim?

"A man who cares so much for men that he proposes to make a permanent place in the youth and the hope of the human race. We can understand this better when we understand that this is done under the auspices of a great profession, the profession he follows. Your profession is an important one. For you, the chemist is analyzing atoms, exploring the fundamental quantities and qualities with which chemistry has to do; for you the physicist is exploring the realms upon the very verge of matter; for you the astronomer will by and by be giving directions for the finding of gold; to you the geologist gives that stony record of the history of the world, and unfolds page after page to the earnest student; for you the engineer and mechanic proposes to give better machinery; for you the civil engineer climbs the mountains and measures the distances of the earth. Many experiments may be made in this building that will fail; many a Ponce de Leon in science and mining

engineering has started out to find the region of perpetual youth and has come upon the Florida of fact. Many a discoverer for El Dorado may come upon a Mississippi, muddy but practical.

"But I wish to speak now of another problem, the problem of the refractory man, the man of the low grade ore. As a minister, I come upon many such. The low grade ore that must go to the dumps. We must find some way for treating this material. But I want to say that the same principle underlying the treatment of the problems that confront you, underly the problem of the treatment of the low grade ore in humanity. Some day some wise citizen will erect a laboratory, some abstract lover of the commonwealth will show the way to treat it. It will take time. It will take patience. But the state will measure up to this opportunity, the people will work until the problem is solved. When we solve that problem it will be for me and my church, for the rector in his church, and the Rabbi of the City of Denver, the student in his cloister, for the reformer in his prison, to take your method, and to treat the refractory ore of humanity, and take out of it its gold, and to make life better and purer and richer, and for this, let us all be willing to live, let us all be willing to die."

Presentation of Portraits.

Mr. George M. Post, of the class of '94, presented the portraits of Dr. Regis Chauvenet and Mr. Simon Guggenheim, saying:

"At the meeting of the Alumni Association of the Colorado School of Mines last May, it was decided, by unanimous vote, to secure these two portraits and present them to the school. A committee consisting of Mr. L. B. Skinner '95, Mr. A. R. Hodgson '99, and Mr. G. W. Schneider '94, was appointed to carry the action into effect. The result of this vote and of the efficient labors of the committee we have before us to-day.

"Among the benefactors and friends of our Alma Mater two stand out prominent. The one, twenty-three years ago, appointed to the Presidency of the faculty of the struggling insignificant western School of Mines, saw with prophetic vision a great college emerge from its then obscurity, and set before himself an ideal which it should attain. From that day until the close of his service, he labored devotedly and earnestly. He gave the best years of his life unreservedly to the institution, with this ideal ever set before him. He builded its foundations broad and

deep, upon which a superstructure of commanding strength might be reared. Hampered by insufficient funds always, attacked by adverse interests often, all but discouraged by public and official indifference at times, he labored on with steadfast faith in the future of the school, until there arose upon the foundations he so devotedly laid, a structure of technical education holding a place of first importance in the world.

"We never attain our ideals, yet the standing of the college at the close of his service, with its subsequent development under our able and beloved Dr. Alderson, scarce leaves room between the actual and the ideal. He would refuse the name of benefactor, saying, probably, that he merely did his duty. But the weaving of twenty years of life into the very fabric of this school was the essence of benefaction. He gave to her of his store of learning, his wide grasp of science, his deep knowledge of industry and education, and he left the school rich in all that goes to make a technical college worthy of its name. Commemorative of those labors of love, and in gratitude for the inestimable and lasting value of his services, the Alumni Association, whom I have the honor to represent, has secured, and now presents to the school this portrait of Dr. Regis Chauvenet.

"The other gentleman to whom our Alma Mater owes so much as a benefactor and friend, appreciating the great influence the school has had and will have upon the basal industries of mining and metallurgy in our state and elsewhere, out of his generous heart has bestowed the munificent gift for the dedication of which this day has been set apart. With a noble philanthropy he makes possible a growth in influence, a development of the college which, without it, she could not enjoy. An act of this nature comes home with peculiar force to an alumnus. He feels that an uplift such as this means to his Alma Mater is a distinct uplift to him. So it is especially fitting on an occasion of this kind that the body of the Alumni express something of their appreciation of a benefaction, not alone to their Alma Mater, but to themselves. This magnificent building with its furnishings is a sufficient monument to his broad philanthropy, and it needs no poor words of mine to add luster to it. Yet the Alumni desire to express to him their deep appreciation. In token of such, I have the honor to present to the school, in their behalf, this portrait of Mr. Simon Guggenheim."

Mr. William B. Lewis, of the class of '92, a member of the Board of Trustees, accepted the portraits in behalf of the school.

Dr. Regis Chauvenet, former President of the school, sent the following letter, which was read by President Alderson:

"To the Trustees of the Colorado School of Mines:

"Gentlemen: I take the dedication of your new building as a fitting time to express to you and through you to all interested in the welfare of the School of Mines, my appreciation of the far-sighted generosity that has prompted this enduring gift to the state.

"The personal acknowledgement already made to Mr. Guggenheim would, I feel, be incomplete without this further and more public expression of my gratitude.

"May the building to-day presented perpetuate the memory of its donor as a permanent benefactor of technical education in Colorado.

Respectfully,

REGIS CHAUVENET."

Address of
Mr. Simon Guggenheim.

Simon Guggenheim, the donor of the new building, then presented the keys to the chairman of the Board of Trustees, Dr. John P. Kelly. They were tied together with streamers of blue and white satin ribbon, the colors of the school.

His presentation address was simple, but to the point, and was received with a great deal of favor by those in the hall. He said:

"Mr. President of the Faculty, Board of Trustees, Ladies and Gentlemen: Allow me to thank you and the people of Colorado for the great interest taken in our School of Mines. It is an institution which we fully realize has brilliant prospects; one which has already done much to advance the mineral industry of our state. Justly do we feel proud that our state is furnishing more than its quota of precious metals, so essential to the needs, not only of our own people, but to the entire world as well.

"It has always been my conviction that our citizens should repay in part the obligation they owe to their state. Wealth has its duties no less than great intellectual or spiritual acquirements. It is a responsibility, and each one is the steward of the possessions which he holds and which he should administer for the benefit of all.

"I began my business career in Colorado eighteen years ago. I know of no greater pleasure than in sharing my success with the institution which means so much to our commonwealth. We

have a common duty toward those who have been less fortunate. I assure you all that one of the greatest joys of my life is the fact that I am permitted to help the young men of Colorado to careers which means so much to them.

"I wish to thank the President, Faculty and Trustees for their tireless efforts in making the Colorado School of Mines one of the most useful in America. May the School of Mines meet with every possible success."

Address of
Dr. J. P. Kelly.

Dr. Kelly accepted the keys, saying:

"This whole matter is essentially perfect from our point of view, perfect in the giving, perfect in the receiving, perfect in its future effect upon the school. There is no more fitting way for wealthy and able men to have their good deeds go on for centuries after them than that chosen by the donor of this building. The name over the entrance to Guggenheim Hall will last for centuries after we have passed into dust and succeeding generations will bless Simon Guggenheim.

"Allow me, in the name of the trustees, to thank you for the interest you have shown in this school. These are the keys to the situation—they place the School of Mines in the front rank of the institutions of its kind in the world. These keys open a new era for the Colorado School of Mines. We have long outgrown the appropriations allowed us by the state—they suffice hardly for the incidental operating expenses. New apparatus and new buildings have been needed, and you have done much to point the way towards a great future for the school. It is in education that we must look for a cure of many of the evils that beset our life to-day. It is broad-minded men who enter into the battle for the people and work for the uplifting of mankind.

"It is my further pleasure and distinguished honor to wish you a very long and prosperous life, so that you may be able, for a long time, to look with pride upon the School of Mines, which you have done so much to aid."

Address of
Rabbi W. S. Friedman.

Rabbi W. S. Friedman delivered the concluding address, speaking on "The Making of Men First," and saying:

"The dedication of the Simon Guggenheim Hall, which has called us together this afternoon, is one of unusual significance. It impresses us with the noble public spirit of the modest donor, and with his fine recognition of the moral responsibility that goes with wealth. None of our citizens has been more eager to listen to the appeal of every worthy cause and none has given more liberally to educational, spiritual, and philanthropic efforts. I believe I am strictly within the limits of moderation when I say that Mr. Guggenheim comes very near being the foremost philanthropist of our state.

"And this dedication places in the foreground the surpassing value of one of our cherished educational institutions—the workshop wherein are fashioined the tools which unlock the hidden secrets of our eternal hills. This stately structure, picturesquely located at one of the gateways of our protecting mountains, spaciously commodious and thoroughly equipped for promoting the study of one of our most important industries, will, no doubt, act as an incentive and inspire to splendid emulation others of our citizens who have won fortune in our commonwealth. These exercises mark the completion of another link in the sturdy chain of Colorado's eminent educational facilities.

"The School of Mines typifies efficiency in an industry, which, above all others, has made Colorado the peer of her sister states. Other states exceed us in their agricultural output and in the number of their manufacturing enterprises, but none equals Colorado in the inexhaustible treasures of her mineral resources. It is, therefore, essential that Colorado should claim a school offering unexceptional opportunities for the cultivation of that technical skill in mining and metallurgy which plays so prominent a part in our material welfare.

Moral Worth of Her
Citizens State's Wealth.

"The main asset of a state, however, does not lie in the ability or agility with which the trained head or the humble hand wrests from Mother Earth the story of her birth. In our anxiety for mental superiority and the material rewards that often follow

in its train, we are prone to overlook the fact that valuable as these attainments are, they are not the most valuable and they are not the best, but that more vital than material or mental endowments is the moral worth of our citizenship. And it is this moral worth, above all else, that insures confidence in our state and gives permanent peace to our people.

"The Simon Guggenheim Hall, therefore, is not merely dedicated to expert proficiency in a profession; it is also consecrated to character. And, indeed, no profession is more exacting and insistent in its constant demands for a high standard of character than that of the mining engineer. Peculiar and subtle temptations are his, for he is the repository of the implicit trustfulness of the tenderfoot.

"It goes without saying that the desire to possess a surplus of this world's goods, so that those dependent upon us may be fully provided for, is a perfectly natural ambition. We cannot live on the monotonous plan of immediate necessity. The proverbial rainy day comes to most of us. If people had never taken thought of the morrow, they would probable be tramps to-day, and perhaps starve to death the day after.

"It is the surplus over our animal needs that has inspired educational and philanthropic institutions, that has mothered the arts, fostered the sciences, and built the witnesses of human progress. It has put into operation those contrivances of trade and travel which have banished time and annihilated space. It has introduced the child of the arctic to his brother of the torrid zone. It has irrigated our arid wastes and transformed the great American desert into a smiling paradise. It has made of our mountain fastnesses great safe deposit vaults and has turned over the keys to enterprise and ability. The surplus of goods has, without doubt, enriched humanity.

"But there is a reverse side of the medal. The obsequious reverence paid to the merely rich and their consequent inflated self-esteem, the feverish greed to 'get rich quick,' the frantic scramble for sudden spoil, the insane worship of wealth at any cost, are sapping our moral vigor and stunting our spiritual growth. It is true that mining offers large returns on legitimate investment, but it is also true that the field holds out more dazzling prospects of gratifying human greed.

Great Temptations That Assail Mining Engineers.

"In none is it easier to shear the lambs and send them out bleating into the cold. And for the very reason that the mining engineer is exposed to greater temptations, it is imperative that he nurture that moral power which will strengthen him to resist. A rich vein of gold must run in the character of the graduate of this hall. The good name of the School of Mines is in his hands, and the honor and reputation of our state are largely in his keeping.

"May the Simon Guggenheim Hall symbol the progressive achievements of the mining industry. May there be here developed that scientific knowledge which will shed its light to all the world. May technical skill and stainless character be here united forever in holy wedlock.

"Long live the founder and generous giver of this classic hall. Long live his unselfish spirit and may he always find sweet satisfaction in the consciousness that he is rendering service to his fellowman."

THE SWANWICK, MILES & DRYER PRINTING CO.
1744 Lawrence St., Denver, Colo.